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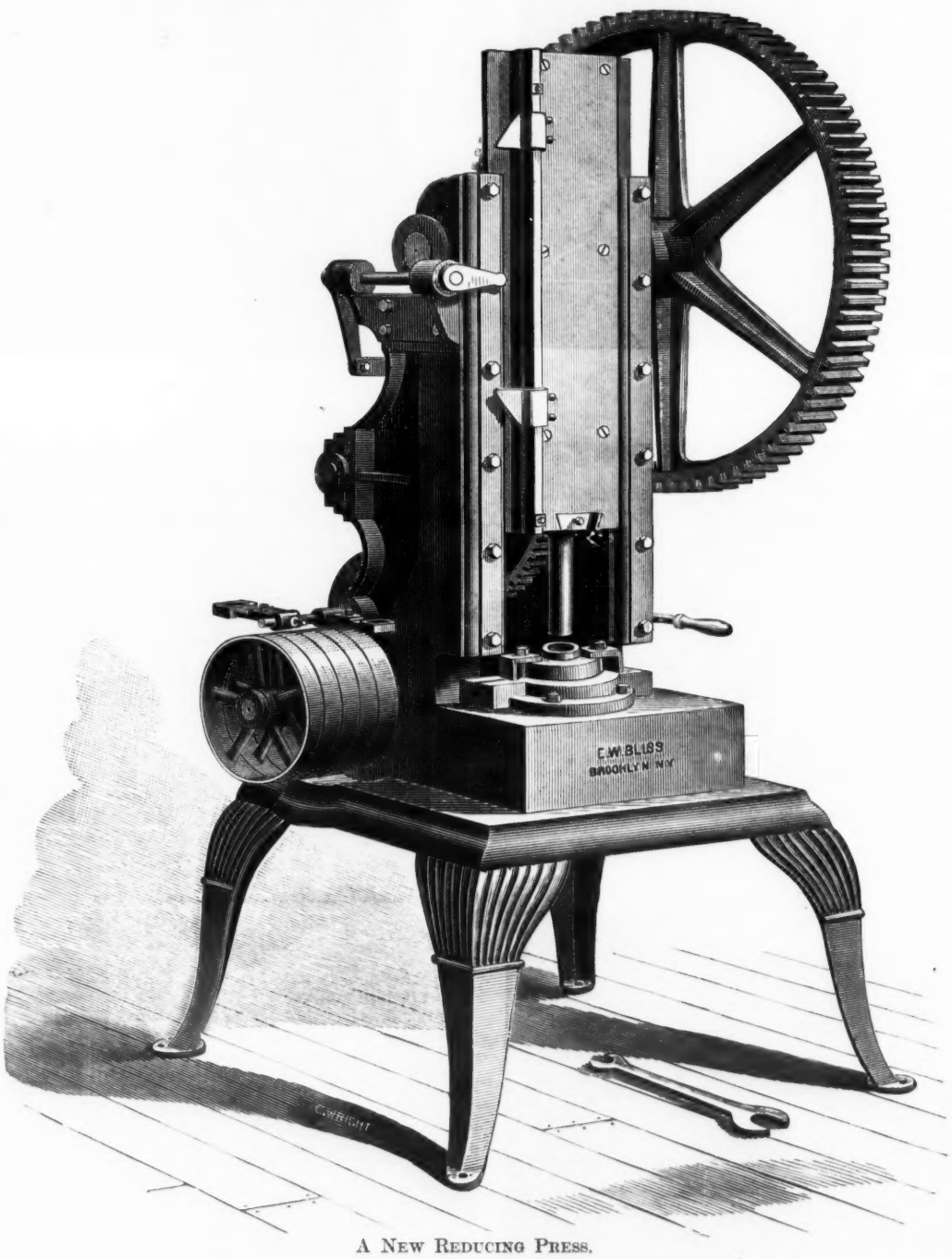
A New Reducing Press.

Perhaps in no single instance has greater progress been made in the last few years than in the class of machines distinctively termed presses, and which are used in the processes of stamping, forming and drawing metals. A few years since and any one of these machines might be taken, without much danger of a mistake, as reprepresenting something ugly in design, and only constructed with a partial reference to the end to be accomplished. This is all changed, and artistically designed machines have taken the place of the ugly contrivances once used in this class of metal industries. To such an extent has this been carried that the art of designing and constructing this class of machinery may be taken to represent a distinct division of engineering science.

The dies used in machines of this character are expensive to make, and their breaking represents a considerable direct pecuniary loss, which in some instances may be exceeded by the loss occasioned by the attendant delay. This requires that the machines should not only be constructed with the greatest care and accuracy, but also that they should be designed, with such complete reference to the strains to which they are subjected, as to resist and neutralize any tendency to spring away from the truthfulness of their construction while in operation; as any failure in this respect not only results in poor work but frequently in breaking or injuring the dies. This requires the exercise of skill and judgment, together with an extended practical experience in the working of this class of machinery.

Our engraving represents a machine of the class mentioned, being a reducing press recently brought out by E. W. Bliss of Brooklyn, N. Y.

This press is *especial'y* designed for the use of silversmiths in the manufacture of covers, cups, goblets, napkin rings, etc., etc., but can, of course, be used for working any of the metals requiring the use of similar tools. An examination of the engraving will show that it is a machine of great strength, while at the same time it is compact and neat in its general appearance.



A NEW REDUCING PRESS.

The slide which carries the mandrel is very accurately fitted to the ways in which it reciprocates; has large wearing surfaces, and is conveniently arranged for perfect adjustment for wear. It has a clear working stroke of more than 24″, which adapts it to be used for drawing tubes up to 12″ long when desired; but, at the same time, the stroke is adjustable to anything shorter than that. The manner in which this adjustment is made, with the two dogs shown in the cut, will be readily comprehended by those used to the operation of iron planers, or other machines in which the length of stroke is adjusted by similar means.

From this it will be seen that these dogs may be readily adjusted, so that the slide, and with it the mandrel, shall traverse regularly and constantly a distance of 24″, or any distance less than that which shall best correspond to the particular work being done. In addition to the dogs, the lever shown at the right hand of the cut, and which is connected with the reversing apparatus, gives the operator full control over the motion of the mandrel, enabling him to stop, start or reverse the motion at any point of the stroke.

The mandrel receives its motion as follows: To the back of the slide which carries it is firmly attached a strong rack, into which works a spur pinion 11″ in diameter, having a width of tooth of 7″. This pinion in turn is moved by a train of spur gearing, which receives its initial movement from the pulley shaft. This last-named shaft is fitted with pulleys 12″ in diameter, and has a speed of 350 revolutions per minute. The proportionate speed of the pulley shaft and the shaft carrying the driving pinion is 118 to 1, giving, as may be readily seen, a very strong motion to the mandrel.

The work throughout is done in the most careful manner by the aid of special tools and machinery.

The weight of this press complete is about 5,000 pounds. Altogether, this machine is a very perfect and complete one of its class, being arranged for first class, rapid work.

Experiments are said to demonstrate that cotton rags saturated with linseed oil will ignite if exposed for any considerable time to a temperature of 170°.

According to Mexican advices General Grant's telegraphic projects will come before the next Congress, and, it is believed, will be approved. They include a submarine cable from Havana to Progresso, and from Progresso overland through Yucatan across the isthmus of Tehuantepec, and a cable down the coast, and to Brazil by way of Aspinwall.

It is said that a plate of finely perforated zinc, about one foot square, placed over a gas jet, will retain nearly all the noxious emanations; the sulphuric acid, generated by the combustion of the gas, combining to form sulphate of zinc on the surface of the plate. If Dr. Joule, who has been experimenting in this direction, establishes this as a fact, it will certainly be a most important discovery, and will remove one serious objection to the use of gas for illuminating purposes.

The patent office has, so far in 1881, issued patents at the yearly rate of 18,778; an increase of nearly 20 per cent. over last year. How many of these are valueless is something only to be determined in the future, but that some which will prove of value have been issued is reasonably certain. The office is self-sustaining, so that in this respect the country has no cause for complaint. It would be interesting — but perhaps discouraging — to know how many law suits were concealed within the leaves of parchment issued to fortunate inventors. If some one would "invent" a means whereby patents would only be issued to those who had an undisputed title to them, it would stand out as the greatest invention of the age; but this is too much to hope for. Philosophers tell us we must not expect the quality of perfection; hence as the captain who put to sea without an almanac had to take the weather as it came, so we must take the patent business—good and bad—satisfying ourselves with the reflection that somehow the evidence afforded by the official reports that we are becoming a nation of inventors denotes progress.

The first line of telegraph was erected less than forty years ago, and at the present time there is more than 1,000,000 miles in operation. The United States comes first with 250,000 miles, with the immediate probability of adding another 100,000 miles; Germany comes next, with 150,000; and the great Chinese empire last, with 1,200 miles.

The directors of the Crystal Palace, at Sydenham, have determined on holding an electrical exhibition in that building in December next. It will be international in its character, and the determination to hold it is said to be, at least in part, due to the dissatisfaction of the foreign exhibitors at Paris.

According to an English newspaper, after a month's trial of the electric light at Scarborough Spa, the directors have ordered the lighting apparatus removed, and will go back to the use of gas.

As an evidence of the rapid increase of new industries in the country, it may be mentioned that the total value of silk goods manufactured in the United States in 1880 was $34,510,843.

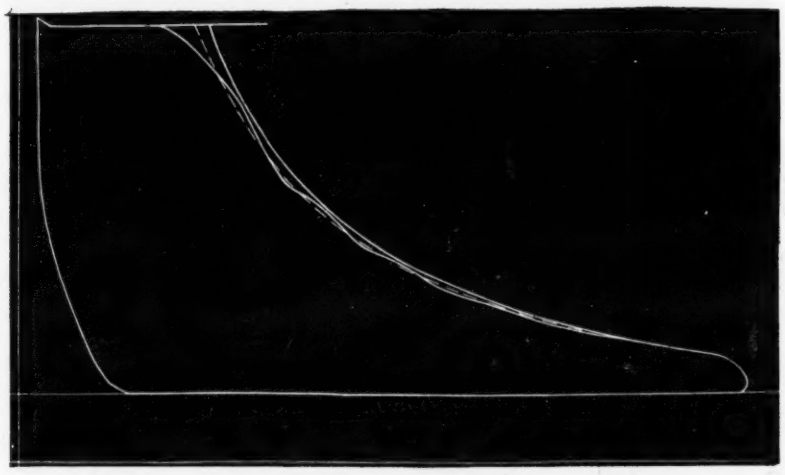
Diagrams of Engine Practice.

In the description last week of the Hartford Automatic Engine, it was stated that Diagrams would be published, illustrating the Company's recommendations as to the load, &c. The five Diagrams on this page are the ones referred to, and to which the following reference is made; noting that their practice contemplates reasonably high piston speed and steam pressure, and comparatively heavy loads.

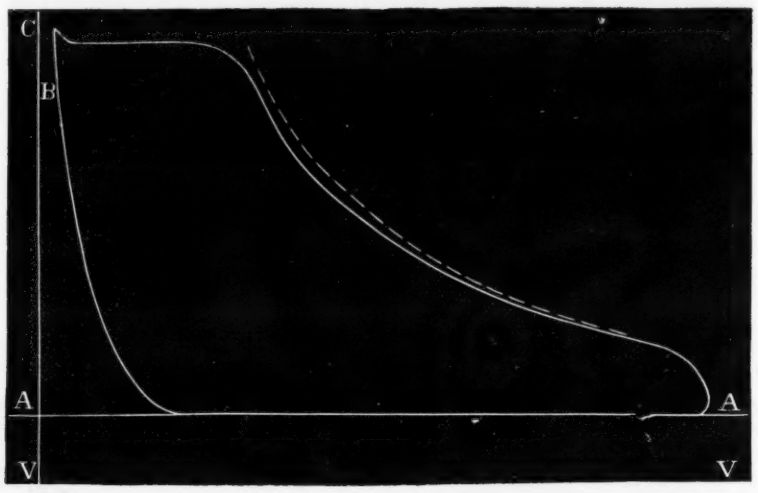
They claim that adherence to these principles secures the lowest first cost of plant; the least expense for maintenance, and the best attainable results as to economy of fuel.

With the valves set to a working load as represented by No. 1 or 2, the range of power under the control of the governor is beautifully represented by Nos. 4 and 5.

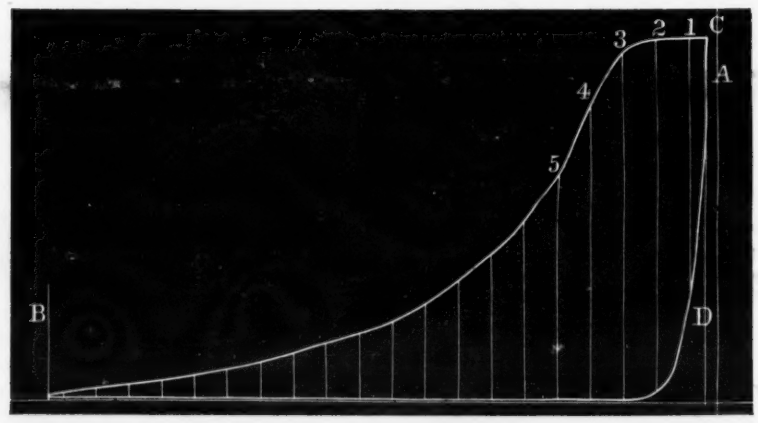
We illustrate our practice as to loads by the following diagrams, which for comparison we will consider as applied to an



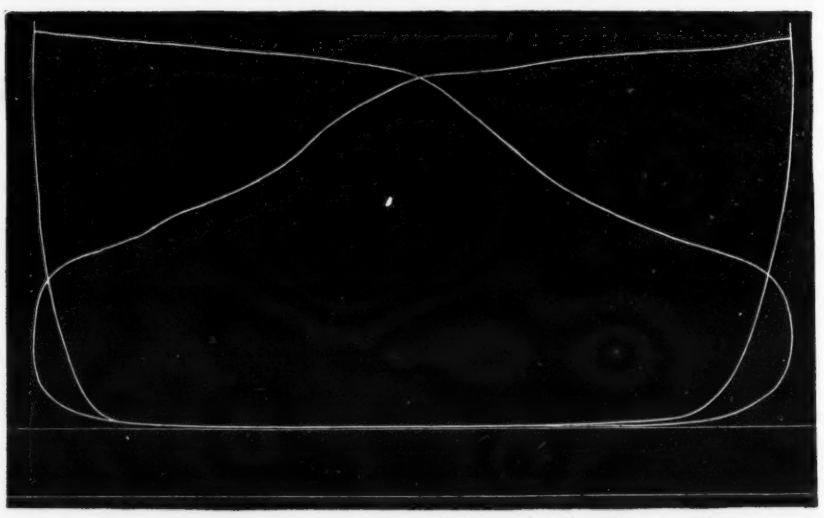
No. 1.—MINIMUM LOAD FOR BEST ECONOMY.



No. 2.—MAXIMUM LOAD FOR BEST ECONOMY.



No. 3.—LEAST ADMISSABLE LOAD.



No. 4.—ULTIMATE CAPACITY.

No. 5.—CAPABILITY OF CUT-OFF.

18" x 30" making 125 revolutions per minute. Scale of all diagrams 40 lbs.

No. 1, Initial Pressure.....80 lbs.
M. E. P. of actual card.....36.73 lbs.
M. E. P. to adiabatic curve.....37.8 lbs.
Efficiency.....97.17 per ct.
Dry steam per H. P. per hour..19.18 lbs.
H. P. Developed.....176.7 H. P.
No. 2, Initial Pressure.....81 lbs.
M. E. P. of actual card.....42.2 lbs.
M. E. P. to adiabatic curve.....43.3 lbs.
Efficiency.....97.46 per ct.
Dry steam per H. P. per hour..19.69 lbs.
H. P. Developed.....203.2 H. P.
No. 3, Initial Pressure.....79 lbs.
M. E. P.....25.68 lbs.
Dry steam per H. P. per hour..25.87 lbs.
H. P. Developed.....123.6 H. P.
No. 4, Initial Pressure.....86 lbs.
M. E. P.....62.69 lbs.
Dry steam per H. P. per hour 24.8 lbs.
H. P. Developed.....301.7 H. P.

No. 3 contrasted with No. 4 further illustrates that over light loads show greater wastefulness than over heavy loads, in proportion to power realized.

A Mutual Aid Society.

In some large machine shops mutual aid societies have been formed, for the purpose of assisting those who become sick or are disabled by accident. A benefit of a few dollars a week is of great assistance to men in such circumstances, especially those who have families, and who have not succeeded in saving anything for "a rainy day." As an example, we will refer to a benefit society which has worked very satisfactorily in the Niles Tool Works, Hamilton, O., the Constitution and By-Laws of which we give below. There is no surplus fund in the treasury, but an assessment of 5 cents a week is made upon each member to pay benefits. This is collected only when members are sick or disabled;

CONSTITUTION.

ARTICLE 1.—The name of this Society shall be the Niles Tool Works Mutual Aid Society.

ART. 2.—This is for the purpose of giving aid to its members who may become disabled through sickness or accident.

ART. 3.—To be a member of this Society, the person must be employed at the works.

ART. 4.—No person shall be a member of this Society until he signs the Constitution and pays an Initiation Fee of 10 cents.

ART. 5.—Weekly benefits of the members of this Society through sickness or accident, shall be $5 per week to be paid by assessment of its members. For a fractional part of a week no benefits will be paid.

ART. 6.—There shall be a committee of five elected annually to transact the business of the Society.

BY-LAWS.

SECTION 1.—Where there is any doubt in regard to a member's sickness, a Doctor's certificate must be furnished.

SEC. 2.—Should a member report himself, or cause it to be done, to obtain benefits when such sickness or disability proceeds from intemperance or immoral conduct, the benefits shall be null and void.

SEC. 3.—The Committee elected shall have the power to elect their own officers.

SEC. 4.—Any member who fails to pay his assessment after one week, shall have his name dropped from the list.

SEC. 5.—Benefits shall be paid to a sick member for no longer than three months.

SEC. 6.—Sick members will not receive any aid for the first week.

SEC. 7.—No person shall be admitted who is afflicted with chronic disease.

Sparks.

We make the following extracts from a treatise on "The Treatment of Steel" by the Crescent Steel Works, Pittsburgh, Pa.:

Overheated steel tells its own story.

A high heat opens the grain of steel and prevents refining.

Cast steel properly hardened is invariably refined thereby.

The temper of steel is regulated by percentage of carbon.

The iron used in making steel determines its quality.

Consumers of steel should be guided by makers' advices.

Sulphur is an enemy to steel.

Good fuel is essential to best results in working steel.

Charcoal, from sound wood, is the king of fuels.

Avoid exposing hot steel to draughts of air.

Pure water is a good hardening medium.

Cherry red is a safe heat for steel.

Nick cold steel with sharp chisels.

A good softening heat, for forging, can be safely used if proper precautions are observed.

The lead screws of lathes are often responsible for inaccuracies in the threads of taps.

Large pieces may often be protected in heating by being covered with a coating of dry clay.

No annealing, is better than over-annealing.

Be sparing of the blast.

Time and care are necessary in the treatment of steel.

Burnt steel is disintegrated steel.

Properly constructed furnaces will pay for themselves in the value of tools which will be saved by their use.

"Soaking," or long continued heats, even if low, are injurious to steel.

It requires a high order of talent to treat high grade steel successfully.

In heating for hardening, great care should be taken with irregular shapes that no part of the piece be too hot.

Steel which has been annealed at a high heat will not harden on the surface.

A low red heat will anneal steel thoroughly.

Do not try to harden steel that has been annealed before turning off the surface.

He is a good steel worker who NEVER spoilt a piece of steel.

Do not be deceived by nostrums for restoring burnt steel.

The peculiarities and proper treatment of steel are studies for a lifetime.

Benjamin Huntsman is said to have invented the cast steel process in 1770.

Crucible cast steel is recognized the world over as the best steel.

Low-priced steel may be very dear steel.

Steel is mercurial and delicately responsive to heat; its records appear in its own structure.

The last age: the age of steel.

Dirty slack fires put dirty sulphurous oxides on steel.

The hardening heat varies with each temper of steel, and the only safe course is to harden at the lowest heat that, on trial, is found to give the required hardness.

Hardening cracks are more often the result of uneven heating than of any defect in steel.

At the iron works of Hewes & Phillips, Newark, N. J., there was melted one day recently 9½ tons of iron in forty minutes. They run a 4½-foot cupola and melt with Connellsville coke.

Counter-Balancing of Engines and other Machinery Having Reciprocating Parts.

BY S. W. ROBINSON.
(Prof. Mechanical Engineering Ohio State University, Columbus.)

FROM A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS AT ALTOONA, PA., AUGUST, 1881.

(*Concluded.*)

COUNTER-BALANCING OF RECIPROCATING PARTS.

Now let us consider counterbalancing the weight C, by a revolving piece, the connecting rod still being neglected. Suppose a counter weight at K, Fig. 8, diametrically opposite the crank pin B. Let the centrifugal force of the weight K, be indicated on the diagram by $A\ G$, always toward K. The diagram of centrifugal force for the revolution will be the circle to the center A, and radius $A\ G$, as shown. Also in the same diagram, let the pressure due to the reciprocating piston, etc., be represented by $A\ D$, for the crank pin at D. Then, as shown above, $B\ F$ will stand for the pressure upon the pin when at B, though acting on the engine frame at A. Make $A\ I = B\ F$. Then for the crank pin at B, and the counterweight at K, we have the two forces $A\ I$ and $A\ G$, acting at A, the effect of which is their resultant. Finding this by means of the parallelogram $A\ I\ H\ G$, we get $A\ H$ as the force, in magnitude and direction, and active at A, which represents the combined effect of the reciprocating parts and counter weight. Any number of points H, can easily be found. A curve, traced through all the points H, for a revolution will be an ellipse $H\ J\ Q$, as shown, the half length of which will be $A\ J = A\ D - A\ G$, and the half width will be $A\ G$.

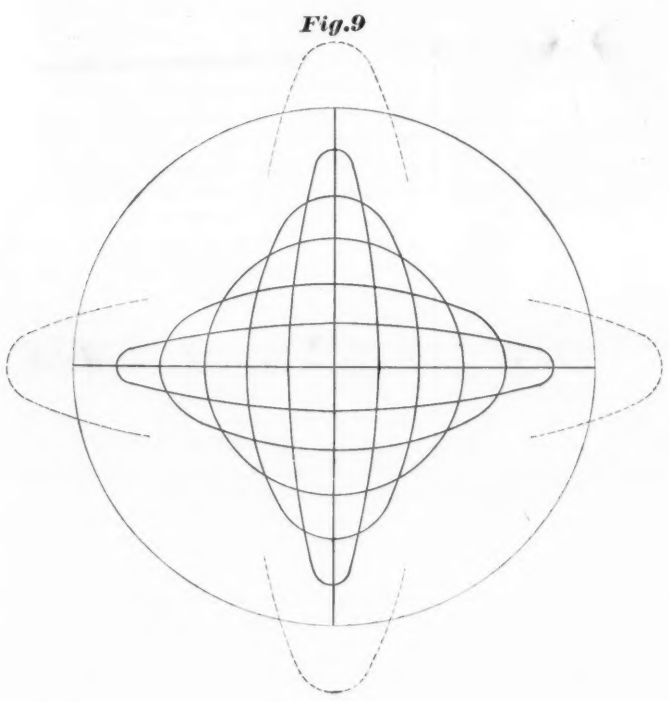
But if the weight K were greater, so as to cause a centrifugal force $A\ L$, the resultant of $A\ L$ and $A\ I$ will give a point M, in another ellipse $M\ N\ P$, the half width $A\ N$ being $= A\ D - A\ L$; and the half length being $A\ L$.

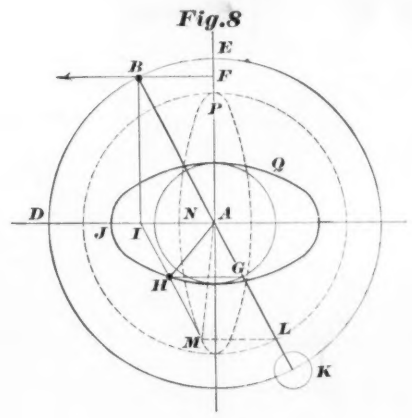
Now, when the piston remains the same, each counter-balance weight K will have its own ellipse. Thus, K might be given a series of values from zero up, and the ellipses drawn. When K is small, the ellipses will be longest in the direction of $A\ D$; and when it is large the ellipses will be longest perpendicularly to $A\ D$. Between these limits the ellipse becomes a circle, the radius of which is half the radius $A\ D$, Fig. 9. When $K = o$, the ellipse becomes a line, viz., the horizontal diameter of the circle of the crank orbit, shown. But when K equals the weight of the reciprocating parts, the ellipse becomes the vertical diameter of the circle. Fig 9.

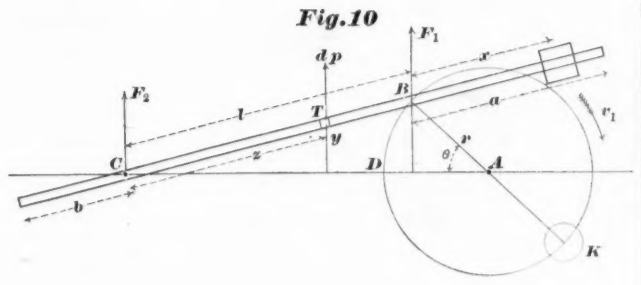
By varying the weight of K, from zero up to equal the reciprocating parts, a series of ellipses such as those shown in Fig. 9, is obtained. It is interesting to note that if K is negative—that is, acts with instead of against, the reciprocating parts, we have ellipses over-reaching the crank circle horizontally. Again, if K is greater than the reciprocating parts, vertically over-reaching ellipses are obtained. These ellipses are indicated in Fig. 9, in dotted lines, and are probably of little or no service in practice.

If the resultant jerking force be represented by a line like $A\ H$, Fig. 8, it will revolve around A in the same direction as does the crank for the case of any dotted over-reaching ellipse, Fig. 9. But when the ellipse is wholly within the circle, as the full line ellipses, Figs. 8 and 9, we notice the extraordinary peculiarity that the resultant force $A\ H$, Fig. 8, revolves around A, in the opposite direction to that of the crank. Hence the shake, when K=half the reciprocating parts, is the same as though everything were removed from the crank, and a weight=half that of the reciprocating parts were centered upon the crank pin, and the crank set to revolving backwards.

As regards the intensity of shake generally, it is due to the resultant $A\ H$, acting at A, revolving backwards, and varying in length according to the proper ellipse. This shake is evidently a minimum when the ellipse becomes the circle, half as large as the crank circle, because the greatest value of the resultant for a revolution is here the least.







From these facts, it appears to be impossible to perfectly counter-balance a reciprocating piece by a single rotating piece.

Next suppose there are two pistons, etc., of equal weight, actuated by one crank pin, the pistons reciprocating in lines $A\ D$ and $A\ E$, Fig. 8, passing through the crank shaft, and at right angles to each other. Then $B\ F$, is the pressure upon the crank pin for one, and $B\ I$, the pressure for the other; both, of course, active at A. Then the line of the crank $A\ B$, is their resultant, in magnitude, direction, and point of application; and it is constant for the entire revolution. It is evident, since the centrifugal force due to a certain weight K, is constant, that a weight K, may be so chosen that its centrifugal force shall just equal the resultant $A\ B$, and we have a perfect balance. When the radius $A\ K$, equals $A\ B$, the weight of the counter-balance K, must equal that of one piston, piston rod and cross head, connecting rod neglected, and in the inverse proportion for other radial distances.

So far, the weight of the connecting rod has been excluded, and the force upon the crank pin, due to the reciprocating parts, has been simply in a line parallel to the reciprocation; the obliquity of the connecting rod having been neglected also.

THE CONNECTING ROD.

This case is peculiar, because one end swings or rotates around with the crank pin, while the other slides or reciprocates with the cross head. The forces made active upon the crank pin will therefore be here due to both reciprocation and rotation. It is evident at once that the resultant action upon the crank pin, for different points in the revolution, will be variable, the greatest intensity being in the line of reciprocation of cross head. The least intensity will be nearly in a line at right angles to this, and, though least for a revolution, it will still be considerable, and too great to neglect.

Also, there will be lateral forces made active upon the cross-head pin, sufficient in high-speed engines to throw the cross-head aslant across the backlash in its slides.

We therefore have three forces to consider, viz.: 1st, longitudinal, or in direction of reciprocation of cross head; 2d, lateral, both upon the crank pin; and 3d, lateral upon the cross-head pin. The intensity of these two last forces depends upon the construction or form of connecting rod. The first two forces may be considered as components of a resultant force.

The first force is evidently the same as if the mass of the connecting rod were all concentrated at C, Fig. 7; and the same rules and principles applied to the reciprocating force C, apply here. That is, at D, the force against the crank pin is equal to the centrifugal force of the mass of the connecting rod, if hung by its center of gravity upon the crank pin; and it varies as the cosine of the crank angle, etc.

The second, or lateral component of force upon crank pin, can only be found by a somewhat extended investigation, such as finding the lateral acceleration of every element of the connecting rod, and referring the effect of all to the crank pin. It will take us too far from the present object to stop for this now. The resulting formulas were given in the original paper, and results of calculation from them will be given now. Fig. 10 will serve us well as a help in explaining these results of calculation.

A pitman of very awkward proportions was taken for the basis of calculation; it being prismatic, overhanging at both ends, and having a weight upon it which could be shifted to any part of the rod. This weight is represented in Fig. 10 as overhanging the crank pin B, to a distance x. Making x negative, places the weight to the left of B. The crank shaft is at A, and the cross-head pin at C, sliding in the horizontal line $A\ C$. At K, is a counter-balance weight, which for our present convenience may always be supposed to have its center of gravity at a point directly opposite to the crank pin, and at a distance from A equal to the crank radius $A\ B$.

The part $B\ C$, corresponds to the ordinary pitman or connecting rod. This pitman overhangs to a distance a beyond the crank pin, and to a distance b, beyond the cross-head pin, as shown.

One important result of the mathematical work, whatever the form of the pitman and attachments, is to the effect that the force F_1, acting upon the crank pin B, in the direction $B\ F$, or perpendicular to $A\ C$, varies as the sine of the angle $B\ A\ D$, or as the length of the perpindicular from B, upon $A\ C$; so that F_1 is readily found by drawing the vertical line from B. Hence this force varies from a maximum at midstroke to 0 at D; according to the same law as the horizontal force upon B, due to the reciprocating piece C, does from D to midstroke. The law of variation of the lateral force F_2, at C, is also found the same as for F_1.* That is, if the lateral force at E, Fig. 8, be $A\ E$, then the lateral force at B will be $I\ B$, and the maximum for F_1 and F_2 is for the crank pin at E. The length and weight of the overhanging parts, however, modify the intensities of these forces F_1 or F_2; even changing the sign of F_2.

1st. Let us first suppose only a prismatic or uniform pitman $B\ C$, which represents nearly the ordinary case of practice. Then the maximum lateral force F_1, at E, Fig. 8, is found to be one-third of the maximum longitudinal force at D, due to the same pitman. Also the maximum lateral force F_2, at C, is a half F_1.

2d. To make the lateral force F_2, at C, zero, so there will be no tendency for this force to shake the cross head, it is found necessary for a prismatic pitman to be extended beyond the crank pin, as far as a half $B\ C$. That is, the pitman being a uniform bar, the crank pin must be at a third its length from the end. Then F_1 will be $\frac{3}{4}$ the longitudinal force at D, due to the same pitman.

3d. With an overhang at B, as in 2d, suppose a weight w, be added to the extreme end; and let $F_2 = O$. Then, if w be one-tenth the weight of pitman, it must be placed at .386 $B\ C$, from B.

Again, if $w = \frac{1}{4}$ the weight of pitman, it must be placed at .28 $B\ C$, from B, toward the right, in Fig. 10.

4th. Now take away the weight and the overhang at B; and let the pitman be a uniform bar, with an overhang at C. Then, to make the lateral force F_2, at C, equal zero, the pin C, must be at a third the length of bar, the same distance, but at opposite end, as in 2d.

5th. Next, the force in the direction of the crank arm, $A\ B$, Fig. 10, was made constant for the entire revolution by means of an overhang at the crank pin, and a weight w, at the end; pitman still a uniform bar. For this it is evident that it was only necessary to make F_1, at E, equal to the longitudinal force of same pitman and weight at D. Then calling W the weight of the pitman bar, if

$w = W$, overhang = .225 $B\ C$, and $F_2 = -.083\ F_1$,
$w = \frac{2}{3} W$, " = .291 $B\ C$, and $F_2 = -.096\ F_1$,
$w = O$, " = .732 $B\ C$, and $F_2 = -.134\ F_1$.

From all these, it appears that whenever the radial thrust upon the crank pin is made constant, there will, necessarily, be a lateral jerking component upon the cross-head pin, and, on account of the negative sign to F_2, will act the opposite way for each jerk, to that due to the ordinary form of connecting rod, considered in "1st."

These figures suggest that it may be impossible to make F_2 zero under the conditions of a constant force in the direction of the revolving crank of $A\ B$. The general equations demonstrated this to be the fact.

Many of these results may be practically demonstrated by bending a common pin into a crank shape to whirl in the fingers, and by sticking it through a narrow strip cut from the edge of a card, with the strip brought up near the pin's head for a crank pin, and the other end of the pin whirled between the fingers. The strip may be left free to the action of the crank. If the crank pin is at one end of the card strip, then a point at $\frac{2}{3}$ the way toward the other end will nearly describe a straight line. Or if the pin be at a third the length, the farther end will nearly describe a straight line, &c., &c.

COUNTER-BALANCING OF PITMAN.

Whenever the lateral and longitudinal forces upon the crank pin are equal to each other in their maximum values, that is, the

* In the investigation, the slight irregularity, explained by the fact that C moves faster in one-half of its stroke than in the other, was neglected.

former at E, and the latter at D, Fig. 8, a counterweight K may be so chosen as to perfectly counter-balance the forces acting on the crank pin. But it is impossible to do this, and at the same time entirely counteract the lateral force on the cross-head pin. It is to be observed that when w is not zero, the longitudinal force upon the crank pin is due to $W+w$ instead of W.

To secure the nearest approach to perfect counter-balance of the pitman, choose a counter-weight, $K=\frac{1}{2}(W+w^1+F^1)$ for the case of the radius $AK=AB$, Fig. 8.

PITMAN AND RECIPROCATING PARTS COMBINED.

In practice we will usually have a pitman combined with *reciprocating parts of some* weight, such as the piston, &c., in engines, or the saw-frame in saw-mills, &c. To realize the best counter-balancing effect on crank shaft, the longitudinal and lateral forces, or thrusts against the crank shaft, for a revolution should be equal to each other. This condition corresponds with that represented by the circle in Figs. 8 and 9.

Hence the resultant action of the forces upon the crank pin will be the combined effect due to the lateral force F_1 of pitman, the longitudinal force due to the pitman, the cross-head piston and rod, &c. The curves representing the action of these forces individually are all ellipses, such as in Fig. 8. Now, if it can be shown that the resultant curve due to the combined action of all the forces is generally an ellipse, then the assumption that makes that ellipse a circle will give the best result, because the counter-weight K can then be so chosen as to give a perfect counter-balance at the main shaft A.

To better comprehend this, take Fig. 12 to represent all the forces, and separately. Let $A\ D$ be the maximum longitudinal force due to the crosshead, piston and rod, C. Let D D, =max. longitudinal force due to the pitman and attachments, and let $E\ E$, represent the max. lateral force due to the pitman and attached parts. Now as the two first named forces vary from the max. by the same law, the two effects may be added together, as is done in Fig. 12, by drawing the circle to the radius $A\ D, = A\ D \times D\ D$. The point H is found as in Fig. 8, giving $A\ H$ the resultant of all the longitudinal forces combined with K. Then H_1 is to be taken as much above H, as B_2 is above B_1; when we find H_1 to be a point in an ellipse, $H_1\ J\ Q$, in which a radius $A\ H_1$ represents the resultant action of all the forces as transmitted to the shaft A. Now when the forces are all laid off to the same scale this ellipse should be a circle, except when external conditions are to be considered, as is subsequently done.

An important consideration here is the effect of the heavy pitman giving a large value $E\ E$, and shortening the ellipse, from the dotted one to the full line one, Fig. 12, because the smaller the ellipse the less will be the disturbing forces.

Hence it is preferable in high-speed engines to make the piston and cross-head as light as possible, and put the weight into the pitman or connecting rod; because the effect of the mass thus disposed, as regards cushion, absorption of power at beginning of stroke, etc., is the same as though it were placed in the piston or crosshead, and the heavy pitman possesses the second, and important advantage of reducing the shake.

An inspection of Fig. 12 shows that for the curve $H_1\ J\ Q$, to be a circle we must have the lateral force $E\ E_1$ due to the heavy pitman equal to $A\ G - A\ Q$; and $A\ Q$ must be equal to the longitudinal force $A\ D$, less the centrifugal force $A\ G$ arising from the counter-balance weight K. Again to entirely destroy the disturbing forces active at A, we must make the circle $H_1\ J\ Q$ vanish in A, and this requires that $E\ E, = A\ D, = A\ G$, necessitating an exceedingly heavy pitman as will be subsequently considered.

But let us first consider $H_1\ J\ Q$ a circle. Calculations show that for this we have quantities related as follows:

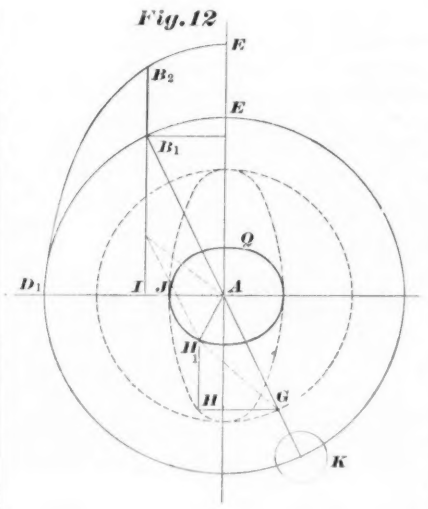
W	w	C	overhang	K	$A\ J$	F_2
50	0	500	0	283	267	8.3
450	0	100	0	350	200	75.
100	350	100	0	467	83	16.7
100	350	100	.198 $B\ C$	550	00	71.
200	102	248	.198 $B\ C$	396	154	00.

In these examples it appears that the jerks upon the crank shaft may be made zero, or that the lateral jerks upon the cross-head pin may be made zero, separately; but they do not seem to ever be zero simultaneously.

Hence, it is impossible to so proportion the parts of an engine, formed as above specified, so as to give an absolutely perfect balance throughout. But the jerks can be thrown wholly upon either the crank or crosshead, according to the wish or choice of the designer.

But, probably the best condition for quiet running of an engine is to so proportion the weights of the parts W, w_1, C and K, as to make the longitudinal jerks zero, and at the same time make $A\ Q$ and F_2 equal and opposite to each other.

Fig. 12



The effect of this adjustment is to give to the engine a jerking "couple," tending to make it rock or vibrate about its center of gravity, and in the same time as the period of rotation of the engine.

A TRIANGULAR PITMAN.

Let us suppose the pitman so modified in form as to be a triangle with its vertex at C, Fig. 10, and a short base at the extremity, the crank pin being inserted at the middle of its width; such a pitman is shown in Fig. 13. Then, to make the lateral force upon cross-head pin equal zero, we find by calculation that the overhang equals a third $B\ C$, and the lateral force upon crank pin equal eight-ninths the longitudinal force due to pitman, whereas the prismatic pitman was three-fourths.

COMBINED TRIANGULAR PITMAN AND RECIPROCATING PARTS.

1st. Suppose the shaking tendencies to all be zero. From calculation it appears that C or W must be negative—a condition impossible to realize in practice.

Hence the triangular pitman does not enable us to wholly destroy the jerking effects.

2d. Next, we observe that the best that we can do is to make these actions upon the crosshead and crank shaft equal and opposite, while the longitudinal jerks are made zero.

As this case is an important one, such as must receive more and more attention, as high speeds are sought to be attained by the help of science as well as workmanship, as notable in the Porter-Allen engine, we bring the figures nearer to practice in the following results obtained by calculation, giving us a table which will be of service in designing engines when it is sought to counter balance them, as contemplated here.

This table is based on the supposition that the weight C of the cross head, piston and rod, added to the weight W of the triangular pitman, is constant, and together equal the weight of the counterbalance K:

If

$\frac{C}{W}=o$, then $\frac{a}{l}=.387, A\ Q = K.037 = F_2, K = W$

" $\frac{2}{3}$ " " $.488, A\ Q = K.094 =$ " " $\frac{1.1}{9}\ W$

" $\frac{4}{5}$ " " $.580, A\ Q = K.134 =$ " " $\frac{1.3}{9}\ W$

" $\frac{2}{3}$ " " $.666, A\ Q = K.166 =$ " " $\frac{1.5}{9}\ W$

" 1 " " $.786, A\ Q = K.202 =$ " " 2 W

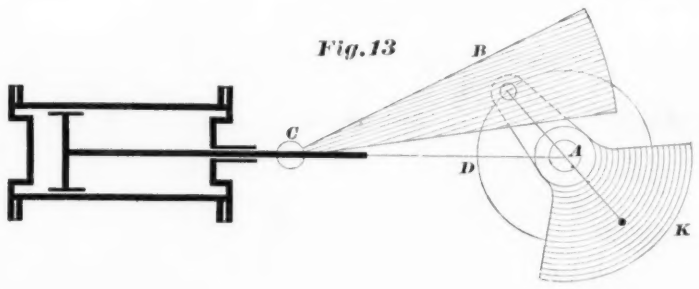
These figures indicate that for a given diameter and stroke of cylinder of an engine, and for a given weight W of a heavy pitman, together with that of the reciprocating parts C, the lateral jerking components $A\ Q$ at A (Fig. 12), or the equal and opposite ones F_2 (at C, Fig. 10), increase with the weight C; also, that the counter balance weight K increases with C, from which it appears that the engine will be subject to much less jerking action when C is made as light as possible, and the weight put into the triangular pitman W. Hence, in practice, the crosshead, piston and rod should be designed first, and reduced to the minimum in weight. Then the pitman is to receive the whole additional mass necessarily added to gain the desired weight of "heavy reciprocating parts."

As a more definite example, take an engine of 14×24 inch cyl., 150 rev. per min., steam at 90 lbs. apparent, and $W+C=720+100=$ 820 lbs. $= K =$ counter balance weight. Then $\frac{a}{l}=444$, $A\ Q = -F_2 = 168$ lbs.

Or, again, interchange the weights, so that $W + C = 100 + 720$, to see the effect of the more usual proportions. Then $\frac{a}{l} = 2.22$, $A\ Q = -F_2 = 1212$ lbs.

In this example the engine will be nearly eight times as unsteady in position as in that of heavy pitman; also the pitman is made to overhang an inconvenient distance in the last example of over twice the pitman length proper.

Fig. 13



If we cut off the overhang of pitman in the last example, it will nearly agree with proportions adopted in present practice. Then, if the circle of Fig. 8 be adopted, $K =$ about $\frac{1}{2}\ (W+C) =$ about 400 lbs,; and the jerking action at crank-bearing, in all directions, will be about 1,600 lbs., nearly tenfold greater unsteadiness than in the example of heavy triangular pitman. The radius of the center of gravity of K is supposed = crank radius.

Again, if the engine has no counter balance K, the longitudinal jerking force will reach the comparatively enormous figure of 3,280 lbs.

The example of heavy pitman seems so important that Fig. 13 is given to better illustrate it. The pitman is to be very wide at the crank end, and to overhang the crank pin a distance $= .444l$, and the counter-weight K is to $= 820$ lbs., the pitman $=$ 720 lbs., and the crosshead, piston and rod, 100 lbs., as mentioned in the example. In this engine the jerking effect in the direction of $A\ C$ is zero. The lateral jerks at A are 168 lbs. up when the crank pin is up, and down when the crank pin is down. At the same time the jerks at C are 168 lbs. up when that at A is down, and down when that at A is up. Under these conditions, if the engine were suspended free, it would have a slight tilting motion about the center of gravity of the whole engine, the angle of this tilt being about a third of a degree of arc. Under these conditions, the center of gravity of the engine remains absolutely fixed. A rocking effect of this sort is evidently less effective in disturbing the engine than a displacing force, as one tends to rock the engine, and the other to move it bodily.

But Fig. 13 is awkward and uncouth in the extreme, according to modern notions of what constitutes good engine design; too much so to be adopted with a relish, notwithstanding its great advantages.

It has been stated that the steam pressure upon the piston, and its reaction upon the cylinder head, contributes nothing toward vibration of engine in any way; because equal and opposite, and in a direct central line. But the pressure of the crosshead upon the guides, being at its maximum at mid-stroke, and in the same direction for both forward and back stroke, will give cause for a tilting or rocking motion in the design of Fig. 13, and with a periodic time half as long as that due to the dynamic force concerned in the heavy pitman of Fig. 13. The extent of this will be about twice that above named, or about two-thirds of a degree of arc. But this is common to all forms of engine. But as regards the dynamic action of reciprocating parts, towards shaking the engine and destroying its foundation the advantage of Fig. 13, as compared with the ordinary construction, is better than as 168 to 3280, or better than 1 to 20, in favor of Fig. 13: better because a tendency to rock is far less objectionable than a displacing force.

In the above investigation of a heavy pitman, the triangular form was chosen for convenience and simplicity of form. In practice, however, it might be modified somewhat for the sake of comeliness.

OUTSIDE CONDITIONS AFFECTING THE COUNTER-BALANCE.

I come now to consider very important conditions affecting the counter balance weight, and which exist outside of the machine itself. To illustrate: suppose a vertical engine is to stand on a brick pier, built up through a basement story of a factory. This pier will probably be made small as allowable, to economize room in the basement.

Now this engine should be perfectly free from jerks in the horizontal, as these would shake the pier and destroy it. But vertical jerks of a very considerable intensity will act in direct line with the pier, and be powerless to disturb it, unless of intensity sufficient to lift the whole engine.

From these considerations it appears that as the lateral jerking affects F_1 and F_2, notably F_1 should be zero at the expense of the longitudinal. That is, the ellipse in Fig. 8, should be reduced to a straight line running lengthwise the engine or vertical.

Again, suppose the engine stands on a floor at same distance from wall or pier supports. The floor will easily spring vertically and vibrate; but horizontally it is stoutly stayed by the walls all around, so that the whole building must vibrate to and fro if the floor shakes any, as it evidently would not appreciably in its own plane. Under these conditions the same vertical engine should be counter balanced in an entirely different manner, the longitudinal shake being made zero at the expense of the lateral. That is the ellipse in Fig. 8 should be reduced to a line running crosswise the engine's center line, so that the jerks will all come in the plane of the floor. The problems already worked out above indicate how not only to reduce the disturbing forces to a line in either the horizontal or vertical direction, but how also to make the length of that line the shortest possible.

What has been said of engines is also true of jigsaws, mortising machines, and the like.

In 1867 the total product of steel rails in the United States was 2,277 tons, which has increased in ten years, or in 1877, to 385,565, and in 1880 to upwards of 950,000 tons. It is estimated that the product for the year 1881 will equal 1,500,000 tons. Alexander L. Holley, John A. Griswold and John F. Winslow were the pioneers of the Bessemer steel industry in this country. The first steel rails made in this country were rolled in Chicago in 1865. In 1870 there were three mills in the United States, fitted to manufacture steel rails. In 1880 there were 11.

Double Circular Saw Table.

The engraving herewith presented represents a double circular saw table, manufactured by P. Pryibil, 461 to 467 West 40th Street, New York.

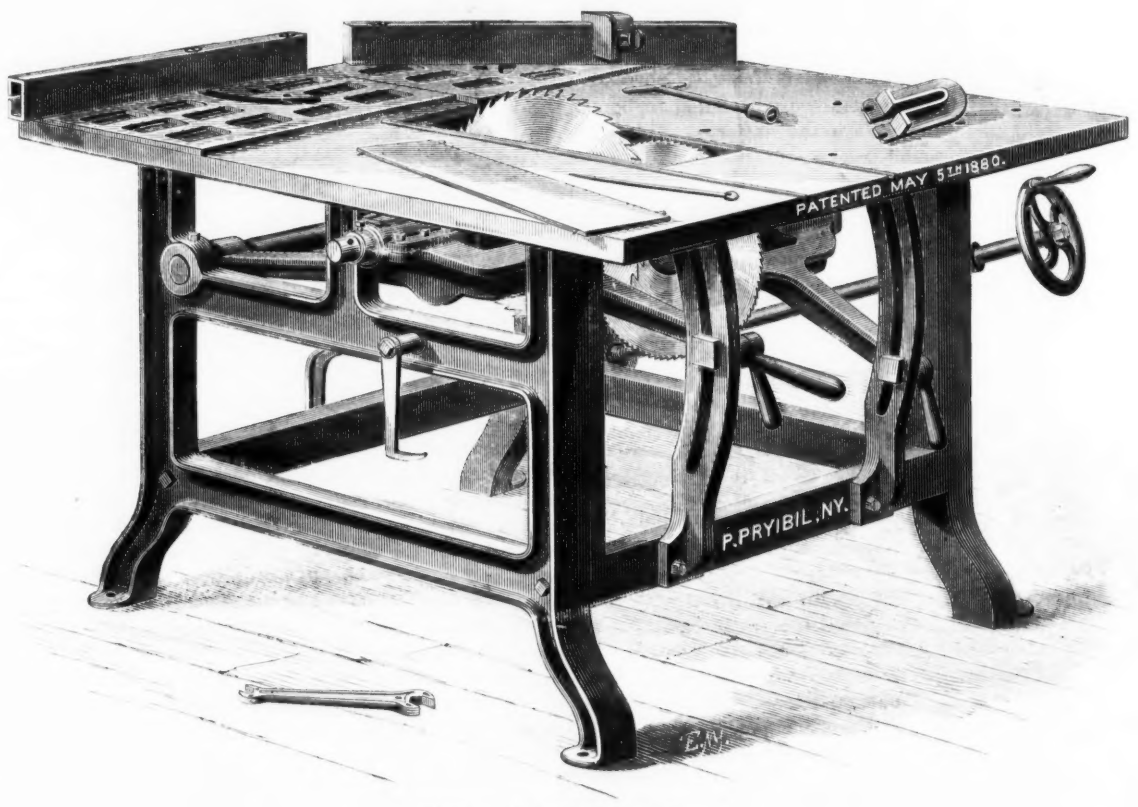
This machine is designed more especially for use in shops that do not have sufficient work for a ripping and cross-cut saw, and can be changed from one to the other in the fraction of a minute. As will be seen, the two saws are carried in swinging frames, so that when one is in use the other is below the table and out of the way. These frames are provided with clamp screws for holding them firmly in any position. When desired, the arbor frame of the cross-cut saw is provided with an adjusting screw, which is operated by the hand wheel shown in the engraving.

The table is of iron, bolted rigidly to the frame, so as always to be level, and is provided with a removable throat-piece which gives easy access to the saw, and also adapts it to the use of a wobble saw or groover, with ripping gauge, right and left-hand carriages, with yoke for coupling the two so that they can be used as one, and with miter fences with gauges. The miter fences are adapted to receive wooden extensions, and the carriages being interchangeable as well as reversible, the miter fences can be used on either side of the work.

In order to get suitable length of belt, as well as to reduce the vibration, the counter-shaft is separate from the machine.

The driving pulleys on the countershaft are provided with friction clutches operated by a foot lever at the front, by which either of the saws can be put in motion or stopped at will.

This machine is designed for the use of a 16″ saw.



DOUBLE CIRCULAR SAW TABLE.

Some experiments have at different times been made, and no end of speculation has been indulged in, with reference to the influence of temperature on the resistance of steel to fracture. According to the *Moniteur Industriel*, the chief cause of the variation in strength is the presence of sulphur; steel or iron which contains no sulphur maintaining the same breaking strain at all observed temperatures, the only change being a trifling variation of the limit of elasticity.

LETTERS FROM PRACTICAL MEN.

"Give Attention to the Safety Valve."

Editor American Machinist:

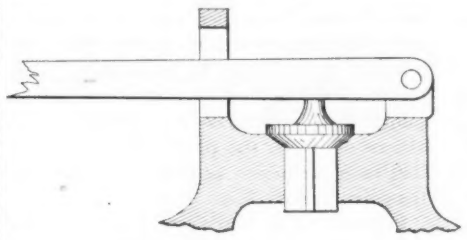
I have had 25 years' experience with steam boilers, and each succeeding year proves to me the unreliability of safety valves, and, indeed, of all other devices calculated to take the place of intelligence in the management of steam boilers.

I think there should be a placard in bold characters hung near every boiler, with this admonition: "Give attention to the safety valve."

While reading your editorial on the Jersey City boiler explosion, I was again reminded of the unsafeness of the safety valve.

I have had an experience with one of these treacherous things, lately, that may be worth relating.

It was a valve on a 60-horse power boiler, which had been undergoing some repairs, and in order to test the strength and character of the work, a hydrostatic pressure of 130 lbs. per inch was applied, at which the valve did not rise, notwithstanding the weight was adjusted to blow off at 90 lbs. This valve was of the usual form, as shown in sketch, and to all appearances was free to move. Besides, it being of brass made the liability



to corrode and stick less probable. Then, again, the engineer had been in the habit of raising the weight every day, having a rope provided for that purpose.

I relieved the valve, again applied water pressure, when it raised with 90 pounds per inch.

Here was the material for a first-class explosion, and if the engineer had survived it, he would have said the safety valve was in order. QUIRK.

Chattanooga, Tenn.

Cone Pulley Diameters.

Editor American Machinist:

Allow me to thank "Votre Ami" for pointing out that, while the tables published in your issue of October 15th were correct, their author has fallen into grievous error whilst illustrating the use of the tables. It was, as Votre Ami courteously stated, an oversight, for the tables could not have been calculated without a clear recognition of the true order of the differences.

Those who may wish to make use of Tables I and II (AMERICAN MACHINIST, Oct. 15th) would do well to work out the examples, and then write at the head of each of the tables: *The largest step is to be regarded as the first step.* The successive steps may then be found by *subtracting* the differences given in table, for average difference = 2½ and distance of centers = 60″, as follows:

	17,50 =	diam. 1st step.
Diff. of 1st and 2d =	2.37	
	15.13 =	" 2d "
" 2d and 3d =	2.43	
	12.70 =	" 3d "
" 3d and 4th =	2.50	
	10.20 =	" 4th "
" 4th and 5th =	2.57	
	7.63 =	" 5th "
" 5th and 6th =	2.63	
	5.00 =	" 6th "

The resulting pairs on the equal cones will then be:

5.00	7.63	10.20	12.70	15.13	17.50
17.50	15.13	12.70	10.20	7.63	5.00

These diameters are practically exact (they are correct within 0.005); moreover, by substituting these diameters in an *exact* formula for length of belt, we find that the greatest variation in the length of belt is only 0.01″, and not 0.04″, as given by Votre Ami. In thus pointing out that the tables are more accurate than Votre Ami supposes, we do not wish to be understood as implying that the effect of a variation of 0.04″ in the length of the belt would be practically appreciable.

At the time when Votre Ami wrote he had evidently not seen Table III (AMERICAN MACHINIST, Oct. 22d). This last table solves all cases which are not solved by Tables I and II; so that the three tables cover the practical cases likely to occur, and the objection does not obtain that they will apply only to special cases. If there should arise cases lying outside of Table III, the latter can be enlarged by any one simply adding 0.03 to the numbers in column 33, and then placing the sums obtained diagonally—that is, one place to the right and one place downwards, and so on. An inspection of the table will show how preceding columns have been obtained

The objection to all the formulas with which the writer is acquainted is that they involve tedious "cut-and-try" processes, or are only approximate. They can, moreover, only be made use of by those who understand algebra or trigonometry, or both.

New Haven, Conn. J. F. KLEIN.

Voyages at Sea—Preparing for the Voyage.

Editor American Machinist:

I propose for the benefit of some younger engineers, to make an imaginary trip around the world in a fine steamship, and will try to give them some idea of the starting, and accidents that may happen at any time. I will commence at the first step, and will go on board of a strange ship with orders to get ready and sail in ten days.

On going on board of the steamship, we find she is a ship of 2,500 tons, having a vertical beam engine. Then by measure—for a chief engineer should know just what he has got in sizes, capacities, volumes, surfaces, &c. of every part of the engine and boilers under his care—we find the cylinder has a diameter of 81″ by 12 feet stroke of piston; volume of piston space, 419 cubic feet; a surface condenser with a volume of 209 cubic feet; an air pump with a volume of 85.5 cubic feet; side wheels 33 feet in diameter, fitted with blades 28 in number, of 16″ in depth by 8.25 feet in length. The two horizontal tubular boilers have a heating surface of 9090 square feet; grate surface 273 square feet; area of tubes 3 360 square feet, and the coal bunkers measure to hold 550 tons of coal.

Since the boilers are our source of power, we will examine them to see that they are safe. According to the ship's certificate, we find that she is allowed to carry a steam pressure of 25 lbs., but we will test it and find out for ourselves, for I would rather depend on my own testing than to trust to some one else. We will use hydraulic pressure for a test, or plainer, cold water forced into the boiler with a force pump. I fill the boilers full, taking care to keep the safety valve open to let the air escape, and when the water begins to run out at the safety valve we close it and apply the force pump (if not already applied), and the pressure will very soon show itself on the gauges. We find at 20 lbs. pressure one or two small leaks in the shell, and that some tubes also leak. These leaks are all marked, and when the water is let out they are repaired by patching the shell and putting in new tubes in place of the leaky ones. After this work is done—to be thorough with our work, we again apply the test, and if all is tight at 52 lbs. per square inch, we conclude we can carry 25 lbs. of steam pressure with safety. We next examine the engine and its connections, first, by looking at and giving to each pipe its proper name; see just where it starts from and where it leads to, and know what every cock and valve is for, and the work it has to perform.

A ship can be sunk just by not knowing what valve to open and which to shut and when to shut them.

A chief engineer should be so well acquainted with these that he can find them in the dark if necessary. All work on a marine engine should be extra well done, for it will not do to run any risks at sea. In case of a breakdown it is very inconvenient to find a shop for repairs when 1,000 miles from land. I will not describe the repairs on our engine at present. Suffice it to say that we find it in very good shape generally. I will give the manner of repairing it in some future letter—after a breakdown perhaps.

Our shipowners have given notice to take on coal enough to carry us from New York, our starting point, to Gibraltar; distance, 3,170 miles. This is a very important question, and one that is very apt to be asked, especially if the ship is running trips of unequal lengths. It is not expected that we shall give just the number of lbs., but they expect a fair and reasonable estimate. The condition of the weather will make considerable difference in the consumption of fuel. The question is how much coal will be required to make the voyage mentioned? We have a cylinder 81″ diameter; engine is 12 feet stroke, cutting off at .45 of stroke, and making 18 revolutions per minute. The steam pressure in steam chest is 20 lbs.; speed of ship, 12 miles per hour; evaporation estimated at 7 lbs. of salt water per lb. of coal. Then area 81″ = 5153.01 ÷ 144 = 35.78 × (cut of) 5.4 + (rev) 18 + 2 (strokes of piston) × 60 (no. of minutes) = 417,337 cubic feet, or volume of steam per hour.

Hence, 417.337 ÷ 001269 density of steam = 328.87 × 64.3125 = 21150 ÷ 7 = 3021 lbs. of coal per hour, and $\frac{3021 \times 24}{2240} = 32.814$ tons of coal per day. Therefore, distance 3170 ÷ (12 × 24) = 11 days' sailing. 32.814 × 11 number of days = 360.954 tons of coal for the trip. To this add 10 per cent. for unfavorable weather, etc., and we have 397.01 tons, which will carry us over.

In my next letter I will try to give some idea of keeping the engineer's log, and will

endeavor to calculate the number of miles run by the revolution register, etc.

Corning, N. Y. STARTING BAR.

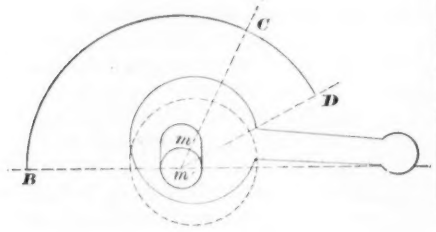
The Rocker Arm Considered.

Editor American Machinist:

Having read in the AMERICAN MACHINIST the article by Prof. John E. Sweet, which contains a description of an automatic cut-off, and having had to become educated up to his standpoint to understand the application of the rocker arm used by him, I thought a few remarks might be of service to others traveling the same road. I shall endeavor to prove that a shifting eccentric does more than change the throw of the valve.

In reducing the throw of a slide valve you increase the proportionate lap. If you increase the lap, either by reducing the throw or adding more lap on the valve, you make an earlier cut-off and the eccentric must be moved forward to make the valve open at the right time—must have more lead.

The lead is measured by the angle of a line drawn through the eccentric center and the center of the crank shaft with the line of the eccentric rod in its neutral position. Referring to sketch when the eccentric is at full throw, the lead is measured by the angle *B C*; suppose the eccentric center to have shifted to *m*, the angle of lead is increased to *B D*. It is obvious that the shifting eccentric reduces the throw, increases the lap, lead of eccentric and point of cut off, and *vice versa*.



The result obtained by Prof. Sweet's rocker arm is to nearly overcome the irregularity caused by the eccentric not being at half throw when at quarter revolution. Say *R* is the pin on which the eccentric rod vibrates, and the throw is equal to *y y*; if the throw is reduced to *y' y'*, it is evident that the distance *y' R* is less than *y R*. Prof. Sweet's rocker arm makes the point *R* travel up and down from *R'* to *R''*, and nearly overcomes this. The same thing can be done by letting the eccentric slide up and down in a box, without moving the rod except backward and forward.

I think Prof. Sweet's piston is not as good as if it had square, straight ends. The steam has to travel through a small crack between cylinder head and piston before it can exert a pressure on the full area at commencement of stroke.

Baltimore, Md. BALANCED VALVE.

Safety Valve Stems.

Editor American Machinist:

In your issue of October 22nd, there is a statement which is as follows: "Never use a safety valve with a wrought iron stem rigidly attached to the valve, and just a sliding fit through a cast-iron cover or bonnet." Now having used that particular class of valve for many a year I wish to state that I never had the least trouble with them. Three or four times during the day I raise the lever, and assure myself of the working order of the valves, and of having the weight placed at the proper place.

I feel just as safe as though I had the best valve that is made, and I say: never let a safety valve get stuck, or corroded, no matter whether the stem, or the cover is made of wrought iron or brass.

H. WINTER,
Central City, Colo.

[A safety valve should be made of metal or a combination of metals which is not liable to corrode and stick.

Almost any kind of a safety valve can be used if the engineer watches it constantly. But a safety valve should be so constructed that raising the valve from its seat once a day will be sufficient to insure its proper working. A boiler exploded September 13, 1881, in Jersey City, which was caused by the wrought iron stem of the safety valve sticking fast in the bonnet. Had this stem been made of brass instead of wrought iron it could not have stuck even if it had been neglected.]

Suction Fan or Blower.

The use of a suction fan for removing shavings and dust from all kinds of wood-working machinery has been common for some time, they having been found very effective for this purpose; but there are many other purposes for which they are equally adapted, but for which they are not so generally used as would seem advisable; such, for instance, as removing smoke and gas from smiths' shops, and, in fact, the impure air from many industrial establishments, and notably the dust from emery wheels. In this respect they may be employed as ventilators of any rooms in which occupations are carried on that create dust, or damp and offensive odors.

If used more generally for these purposes, they would undoubtedly be found to be an important factor in the sanitary conditions of many establishments.

Our engraving represents a new fan for these purposes, which, it is claimed, is effective in operation and cheap in price. This fan may also be used as a blower for conveying hot air to dry rooms, blast under steam boilers, etc., etc., and also for melting iron in small cupolas.

It is manufactured at the Unadilla Machine Works, Unadilla, Otsego County, N. Y.

"The Barb Wire Fence Monopoly."

WORCESTER, MASS., Oct. 24th, 1881.

Editor American Machinist:

Under the above title there appeared in your issue of the 15th inst. an editorial, the statements of which were calculated to mislead the public and impair our reputation for good sense and common honesty. Our objections to that article may be enumerated as follows:—

1st. The assertion that any litigation is going on between us and the Western or Iowa farmers.

2nd. The statement that before the judicial decision in favor of our patents, Barb Fencing could be readily bought by the Iowa farmers at 6 and 7 cents, while the same article cannot now be purchased at less than 10 and 11 cents.

3rd. The assumption that those of our patents which have been re-issued are not as entirely and completely valid as the original patents.

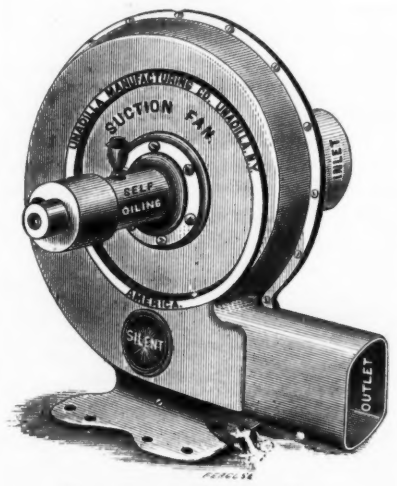
4th. The deductions made from a statement of the amount of Barb Fencing sold in 1880 in the State of Iowa.

5th. The declaration that the owners of the Barb Fence patents are not content with a "legitimate royalty" or have organized an "oppressive monopoly."

To refer to the foregoing in their order:

FIRST. The farmers of the West and Northwest have been large and constant customers of this company for smooth fence wire, from the time that article was first used for such purpose, as well as for all the other kinds of wire needed by them from the organization of those States until the present time. They have, therefore, for many years, borne to us the relation of customers, and friends, and the statement with which the article we are now referring to commences, that we are carrying on an "expensive litigation" with these, our old customers, will be as startling and offensive to them as it is to us. The only occasion for such an intimation is the fact that certain politicians in central Iowa have been and are striving to enlist the farmers of Iowa in their particular political programme, by presenting themselves as champions and protectors of the public with reference to certain alleged abuses of which the public had not, up to that time, seemed to be conscious, including the price of Barb Wire.

SECOND. For two years previous to the 15th of December last, this company and I. L. Ellwood as owners of what are termed the bottom patents on Barb Fencing, had been conducting litigation against a large number of parties throughout the United States, who, as manufacturers, had been infringing upon their patents. During that time, especially during the last year, it is quite possible that, in view of the probable results of such litigation, those parties did



NEW CHEAP SUCTION FAN.

sell a great deal of Barb Fencing at cost, or less, say at 6 and 7 cents per pound; but today the bulk of the sales by ourselves and the parties and companies we have licensed, as is the case with most great staples of trade, are not made to the consumers but to the jobbers and dealers of the country, and at 7¼ cents per lb., which includes the license fee of ¾ of one cent. Therefore, whatever the consumer pays over and above 7¾ cents per lb. is the profit of the jobber and dealer, no part of which comes into the pockets of ourselves or our licensees.

We desire to state emphatically that the great bulk of all the Barb Fencing, manufactured under our patents, is sold at 7¾ cents per pound for the painted or japanned, and 8¾ cents for the galvanized, and out of this there is paid to the owners of the patents ¾ of a cent per pound. And so well known are the prices and terms ruling for Barb Fencing that not only Judge Cole (whose statement seems to have been your chief source of information with reference to this subject), but all intelligent farmers in Iowa know that they can buy all the Barb Fencing they desire at the above price, with such a commission added as they can arrange with the agent, dealer or jobber.

THIRD. The re-issued patents, under which we brought suits against infringing manufacturers, and which were adjudicated without exception in our favor, were, on special petition, brought a second time before Judges Blodgett and Drummond in the United States Circuit Court at Chicago, and subjected to a careful revision by those judges, with express reference to the identical charge now adduced by Mr. Cole, and the result was reiteration on the part of those judges of their entire confidence in, and their approval of, the re-issues as such; which should dispose of all such ex-parte and superficial opinions as Judge Cole seems willing to make upon that important subject.

FOURTH. The false statement is made that "150,000 tons of Barb Fencing were sold last year in the State of Iowa alone."

The truth is that only about forty thousand tons were sold in the whole United States last year, which, by the most liberal estimate, might give a total sale of Barb Fencing in Iowa last year, of not to exceed four thousand tons, and this, at 75 cents per hundred pounds, would yield the owners of the patents $60,000 (sixty thousand dollars) in royalties, instead of two millions, two hundred and fifty thousand dollars!

Again, on the authority of Judge Cole, it is represented that "The Association stands ready to pay this royalty of ¼ of a cent per pound, and after completing their arrangements, will furnish wire at 7 cents per lb.; but that its members protest against paying in one State an additional sum of $9,000,000 yearly, which is the difference between the price at which they will sell it after paying what they consider a fair royalty, i. e., ¼ of a cent per pound, and the price they have to pay for it as at present manufactured by the Washburn & Moen M'f'g. Co., or under their license."

But what is the "additional sum," against which the protest is made? Judge Cole makes it up as follows: "The farmers of Iowa after putting 75 cents per hundred in the pockets of the Washburn & Moen M'f'g. Co., do not propose to pay them three cents per pound more than the 7 cents per pound," at which he claims the wire can be made, and sold at a profit. Three cents a pound is $60 a ton, and $60 a ton on 150,000 tons is the $9,000,000.

But 3 cents per pound for 4,000 tons used in the State of Iowa last year would amount to $240,000 and not to $9,000,000.

Now, what can Washburn & Moen M'f'g. Co. and their licensees make over and above their license fee when they sell the painted Barb Fencing at 7¾ cents a pound? The cost of Barb Fencing is as follows:

Wire suitable for Barb Fencing in Chicago 4¾ cents; freight to Iowa ¼ cent; manufacturing 1 cent; royalties ¾ cent. This makes a total of 6¾ cents per pound. The difference between this and 7¼ cents leaves 1 cent per pound, but from this must be deducted bad debts, and all incident charges and liabilities, which will reduce this 1 cent to ¾ of a cent, as the entire net profit that can accrue to Washburn & Moen M'f'g. Co., to I. L. Ellwood & Co., or to their licensees, outside of the license fee; ¾ of a cent a pound on the 4,000 tons sold in Iowa in 1880 is $60,000 and not $9,000,000.

The truth is therefore with reference to this part of the statement which Mr. Cole leads you to publish, that the farmers of Iowa, while prices remain as at present, are called on to pay in license fees on each 4,000 tons of Barb Fencing $60,000, and in net profit $60,000, making a total of $120,000—and not $2,250,000 and $9,000,000, "additional"—an astounding total of $11,250,000.

FIFTH.—In answer to the grave and specific charges of Judge Cole, that we have sought to exact from the farmers of Iowa something more than a "legitimate royalty," and, in addition, to organize an "oppressive monopoly," we have to submit: that Judge Cole over his own signature, has given as the verdict of the Iowa farmers that we had settled upon a royalty fee which was not only fair but one which they were willing to pay; and, our statement above, with reference to what is the profit of the Washburn & Moen Manufacturing Company and I. L. Ellwood & Co., and their licensees. Neither the farmers of Iowa nor of any other part of this country, want us or those associated with us to work for nothing, and we assume that they are entirely willing to allow us and our associates at the rate of $60,000 per annum on each 4,000 tons of Barb Fencing which the State of Iowa may consume; especially when it includes entire immunity from charges and suits for infringement under Barb Fence patents, which would inevitably annoy them, in whole and in detail, were it not for the work we have done in the way of placing all controlling patents on the subject in one ownership, which has pledged itself to the policy of attacking infringing manufacturers rather than the consumer.

According to Judge Cole's own course of reasoning, the farmers would be utterly without excuse in resorting to litigation, or to the expression of any dissatisfaction, at anything we or our licensees have done in connection with the great question of Barb Fencing; much less is there any justice in suspicions with reference to the invalidity of our patents; and still less ground for the charges of fraud in connection therewith.

In view of all this we submit that Judge Cole's statement instead of being a "strong case" against us, "of extortion" of "outrageous prices" for our goods, or a suggestion of our having given any "Association" any occasion for resistance to our patent, or that we have been guilty of originating or sustaining any system by which any of our customers, including the farmers of the State of Iowa, have been overcharged, are not only without foundation, but, the more this subject is studied, the more clearly will it appear that we and our associates (I. L. Ellwood & Co., of DeKalb, Ill., and forty-one licensees distributed throughout the United States) deserve the credit that belongs to those by whose exertions a new and important article of trade and farm utility has been invented and perfected, and the just rewards provided by our patent system for this class of effort.

WASHBURN & MOEN MANUFACTURING CO.

The Lambertville Iron Works Automatic Engine.

The accompanying engravings represent a new automatic steam engine recently brought out by A. Welch, Jr., proprietor of the Lambertville Iron Works, Lambertville, New Jersey.

The engravings represent a front and back view of the engine, and a diagram, or, more properly, a sketch of the valve motion.

Referring to these, it will be seen that the bed conforms in its general features to those in common use for high-speed automatic engines; that is, it is constructed to rest on the foundation for its entire length, being provided with large bearing surface for that purpose, and the cylinder, which is overhung, being bolted to the end in the usual manner. In other respects its construction is one of great strength, it being stiffened and otherwise rendered rigid in a manner that suggests but little to be added. The pillow block, to which the strains are conducted in as direct a manner as possible, strikes the close observer as being perhaps unnecessarily massive, but the distribution of metal is made in such a manner that it is symmetrical in its proportions.

In this, as in all automatic engines, the important feature is the valve motion, which is of the releasing type, and may be described as follows: The main slide is a flat *D*, provided on its inner surface with the usual exhaust cavity, and with two ports, similar to those in valves on which a Meyer, or other forms of riding cut-offs are used. This valve is moved by an eccentric in the usual manner, and at all times controls the lead and exhaust without reference to the point of cut-off. It is balanced by a plate connected by a ball and socket attachment, to an extent that renders its motion substantially frictionless; while by means of the ball and socket attachment this plate can be adjusted to perfect and equal contact. The two ports which are previously mentioned as situated on the inner surface or face of this valve, are prolonged towards the back, where they take the multiform or gridiron shape, consisting of a number of long, narrow ports. Upon the back of this valve is situated the cut-off valve, which is also balanced, and ported to correspond with the ports in the main valve.

The stem of the main valve is pierced with a central hole, through which passes the stem of the cut-off valve. This stem is extended through the spring box *D*, Fig. 1, and is adjusted with reference to the spiral spring, shown in that box, in such a manner that the cut-off valve will at all times, except when acted upon by some other force, be held in a position to cover the ports in the back of the main valve, thereby entirely excluding the passage of steam from the steam chest to the cylinder.

The spring box *D* also forms the slide for the main valve, the valve stem of which is attached to it, as shown in the engraving. From this it will be seen, since the spring box or slide carries with it in its motion the cut-off valve, thereby maintaining the same relative position of main and cut-off valves, that under the conditions assumed the engine may make a part or the whole of a revolution without the admission to the cylinder of any steam whatever.

The cut-off valve is opened from the motion of an eccentric, the rod of which operates tappets in connection with a rock arm, and which, in turn, engage with corresponding projections on the prolongation of the valve stem. This eccentric is set with lead, referable to the eccentric that operates the main valve, or in other words, its angular advance is enough greater than that of the main eccentric to have opened the cut-off valve ports in advance of the opening of the port into the cylinder by the main valve, thereby effectually preventing any wire drawing of steam at the shortest point of cut-off.

In other respects, the motions imparted to the main and cut-off valves by the separate eccentrics is in the same direction, the only further difference being that the throw of the cut-off eccentric is a trifle more than that of the main eccentric.

The relative motion of the two valves differing so slightly, the tappets are brought together noiselessly, and the motion of the two valves continue substantially together until the time for closing, which is automatically determined by the governor in the following manner: The rock arm, to which the eccentric rod and tappets are connected, is suspended from a slide, to which the governor is attached in such a manner as to lower or raise it (according to the position of the balls), by which means the tappets are adjusted to a greater or less depth of contact, and are consequently released later or earlier in the stroke of the piston. When the tappets come in contact and open the cut-off valve, the spring in the spring box is compressed, and when the contact is broken this spring operates to close the cut-off valve, and the two valves complete the remainder of the single stroke together, and with the steam cut-off from the cylinder.

The closing is instantaneous, the motion being arrested by air cushions in the ends of the spring box.

From diagram, Fig. 1, in which for convenience the center of oscillation of the rock shaft is represented as situated below instead of above the center line of motion, it will be seen that the motion imparted by the cut-off eccentric, through the rock arm to the tappets, is such as to maintain the proper condition for releasing the cut-off valve at any point of the stroke; hence the range of cut-off is practically through the entire stroke of the engine, the small increase of travel and lead of the cut-off eccentric being inoperative to disturb this condition until the lap of the main valve has closed the port to the cylinder.

The short travel of the cut-off valve makes the wear of the tappets very slight, and interposes but little resistance to the operation of the governor to regualte the speed.

The entire valve mechanism is simple, and of a construction to be readily comprehended, while the positive character of the tappet motion making a failure to hook on impossible; together with the quick action of the spring and the trifling motion necessary to close the cut-off valve, (about $\frac{3}{8}$"), make it possible to run this engine at any desired speed; a condition which is provided for by the rigidity of the bed and the ample proportion of the wearing parts, as well as by accurate counter-balancing.

The flat wearing surfaces of both valves and the fact that they are correctly balanced provides for their remaining tight in use, and tends to relieve the governor to such an extent as to insure good regulation; while the wide range of cut-off makes the entire capacity of the engine *under full control of the governor* available at any time.

One of these engines is in operation, in connection with the electric lights, at the fair of the American Institute in this city.

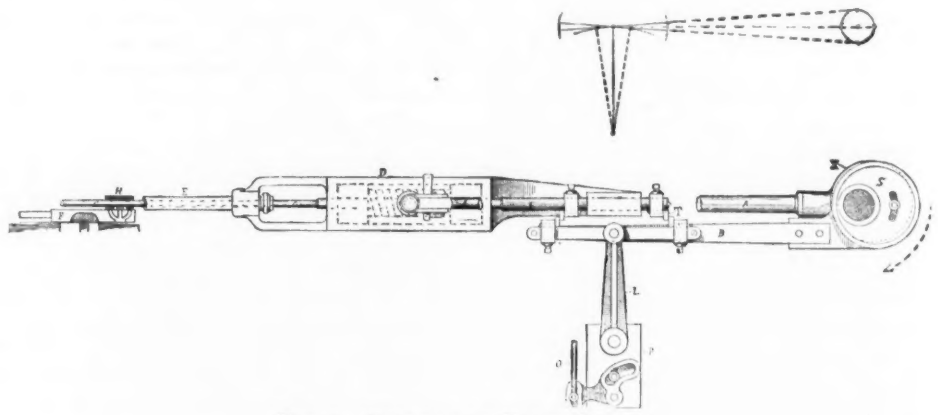
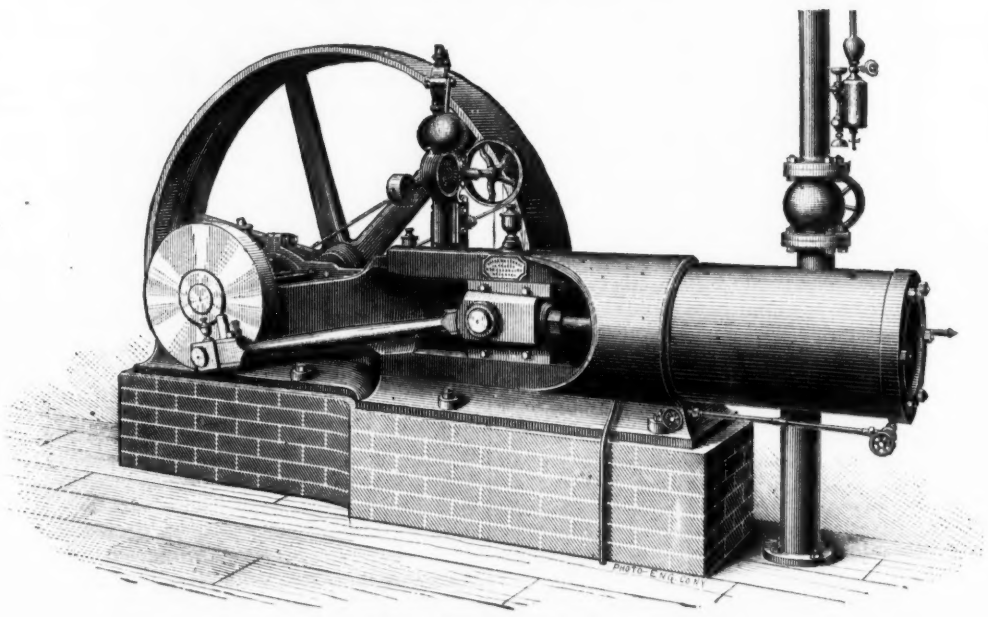
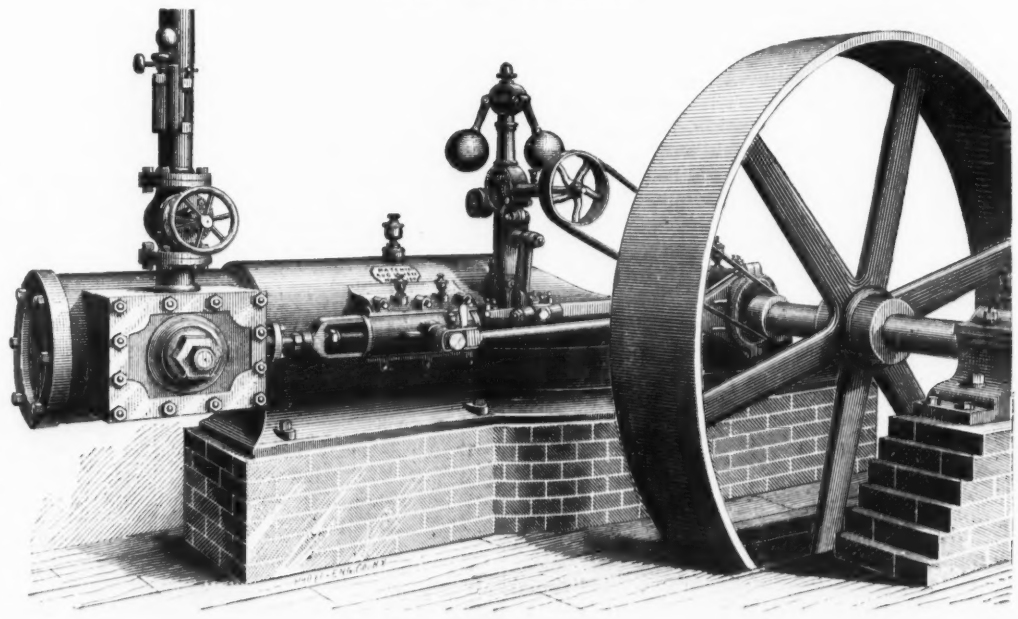


FIG. 1.—DIAGRAM OF VALVE MOTION.



FRONT VIEW OF ENGINE.



BACK VIEW OF ENGINE.

The system of underground telegraph wires has been adopted in Philadelphia, and a company is busy digging trenches and laying tubes. A trench is dug in the middle of the street, three feet nine inches in depth. The bottom and sides of the trench are lined with concrete. The tubes, two inches in diameter, are then put in place, five in a row, and four rows, one above the other. A composition of pitch and slag is then poured in, until the pipes are covered, after which the top is cemented with concrete. The ditch is then filled in and the earth rammed down. It is calculated that the twenty tubes will accommodate from 1,000 to 1,500 wires. A manhole is placed in each square, and the wires will be forced through after the tubes are all laid. The work is mostly done at night.

Fall Meeting of the American Institute of Mining Engineers.

The fall meeting of this Society which has just closed at Harrisburg, Pa., was full of interest to the large number of members in attendance.

Valuable papers were read and discussed, and excursions to places of interest were made. The interest in the society by the citizens of Harrisburg and the places visited found expression in complimentaay dinners, lunches and receptions.

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☞ *Every correspondent, in order to insure attention should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, NOVEMBER 12, 1881.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

Our Silent Industries.

The manufacturing resources of our country have, during the past two years, shown an expansibility not heretofore deemed possible. The demand for machinery (the basis of every branch of manufacturing) has surprised those who supply it no less than those who require it to carry on their business. To equip a new shop with new tools before this unprecedented boom set in needed (besides sufficient capital) only a few weeks time, now the same enterprise necessitates waiting several months to get the tools built. As a consequence some machine tool builders have orders booked as long as *one year ahead*. The question is anxiously propounded, How long is this state of affairs going to last? Some are apprehensive of a lull in the unusual activity. On the other hand there are thousands of people anxious to invest money in new manufacturing establishments who earnestly desire to see a lull. These people are watching and waiting—not exactly "for something to turn up," but for some good opportunity to fit up new establishments with tools and machines without waiting through a period of six to eighteen months to get a shop ready to begin business.

Numerous manufacturing projects have been matured and capital pledged, but for the reason here set forth they lie dormant, and will remain so until there is some abatement in the rush of orders for machinery. These substantial projects constitute our *silent industries*—a mighty reserve force, the benefit of which will be felt when there are any indications that it is needed. Even such a contingency as a general falling off in orders for shop equipments need not, in times like the present, be regarded with any serious apprehension. When machinery manufacturers have all they can do, it is rather a disadvantage than otherwise to be obliged to book orders to be filled six months hence, for no one can predict with absolute safety what it will cost to build machinery next spring.

Sooner or later a lull in long-time orders will be experienced, but the most sagacious manufacturers will not be alarmed when this change occurs.

Individual Advancement of Mechanics.

While an honest difference of opinion may exist between those who pay and those who receive wages, there is one point upon which the more thoughtful of both classes are agreed, and that is the impractibility, or more than that, the impossibility of giving to each individual, amongst a large number of workmen, his share of the total amount paid as wages. It might at first thought appear that employers would be the least interested in this matter, but some experience and a good many expressions from this class lead to the belief that they appreciate even more than the workmen themselves do, the fact that strict justice cannot be done in this respect.

The classing, for instance, of a certain number of men as machinists, and consequently entitling them to so many dollars and cents in the way of wages, has too much of the old patriarchal economy about it to suit the times, and the matter is not particularly bettered by dividing a shop's complement of men into a first and second class, and grading their pay accordingly. The fact is that the services of every individual mechanic have, or ought to have, a value as distinct as his own individuality, and should be paid for without the slightest reference to anything else. Nothing else will bring out all there is in a man, and nothing is more needed at the present time than individual progress. We say "ought to have," because the plan of leveling men in respect to wages has a powerful influence towards leveling them in respect to ability. In a world of dollars and cents these representatives of something to be bought with them are the great incentive to action, and when you make it manifest to the individual that painstaking on his part will not put him in possession of more of them, that incentive is lost.

It is natural, and in every way commendable, that a man should endeavor to *earn* and *receive* as much in the way of wages as possible, but improvement in this respect, as in every other, requires exertion; in the case of the mechanic, for instance, an exertion in the way of study beyond that required to enable him to maintain his present standing. It is in the best interests of all that the inducement shall be such as to invite every one to make his best efforts. In the nature of things, a large proportion of those engaged in mechanical pursuits will continue to be what are in contradistinction to proprietors, superintendents, foremen, &c., termed workmen. This does not, and particularly it should not, imply that they know less of the business of their trade, but before the proper incentive to action can be offered to, and accepted by mechanics, it must be evident to them that in lifting themselves up they are not to be dragged back by others; and it must also be equally plain to those who employ them, that in paying one man the wages to which he is justly entitled, they will not be expected to pay twenty men more than they are entitled to receive.

No one thing can do so much to improve the mechanical standing of the country as a knowledge of the fact that swift and substantial recognition awaits every material advance of the individual workman, and further, that workmen should see that no jealousies on their part stand in the way of such a consummation.

It is a point worthy of more consideration than it has received, both from those who pay and from those who receive wages, whether more cannot be done to develop the latent abilities of some mechanics, thereby directly benefiting all parties immediately concerned, and indirectly benefiting the whole country.

In our issue of October 15th, we reviewed some statements of the Washburn & Moen Manufacturing Co. on one hand, and Mr. Cole, representing the Iowa Farmers' Association on the other, regarding the selling price of barb fence wire, and a proposed litigation in regard to a re-issued patent. The Washburn & Moen Co., feeling aggrieved by that article, have been offered the free use of our columns to reply, which offer they have availed themselves of in quite a lengthy letter in the present issue.

Briefly stated the situation is as follows: That company controls several patents on barb wire for fences. They sell the wire at about 7¾c. a pound, *wholesale*, or (for galvanized) 11c. a pound retail. The greater part of it is sold from the wire mills at wholesale. The farmers have to pay the retail price, and think it too high. It may be assuring to them to know that several profits have to come out of the 11 cents a pound they are obliged to pay. Mr. Cole had been badly misinformed as to the amount of barb wire fence sold in one year.

Literary Notes.

THE ENGINEER AND MACHINIST'S DRAWING BOOK. A complete course of instruction for the practical engineer, on the basis of the works of M. Le Blanc and M. M. Armengand. Illustrated by 74 full page steel plates, and several hundred on wood, including select details and comple e machines Published by Blackie & Son, Glasgow and Edinburgh. Sold by John Beacham, 12 Dey Street, New York. Price, $10.50.

The book bearing the above title is one which we have had occasion to call attention to in former numbers of the AMERICAN MACHINIST. The first edition was among the first treatises ever published on the subject of mechanical drawing. Probably no book upon this subject has had so extensive a circulation as this one. The object of the original work was to supply the working engineer and mechanic with a much needed treatise in the educational provision of the workshop. The matter of which the book was made up was previously scattered throughout large and expensive works not accessible to the ordinary individual. This work begins with the argument that every person in any way connected with the mechanic arts ought to possess a knowledge of the principles and practice of drawing. Such knowledge to the superintendent, foreman, and even the workmen is indispensable. Any workman who aspires to fill a higher position must be instructed in the theory and practice of drawing, in order to fill such position with satisfaction to himself and honor to his employers. Drawing may be learned by careful study from this book without a teacher. The construction and use of drawing instruments is fully explained, after which the student is taught to execute the simplest problem of drawing a straight line through two given points. He is then led progressively through a course of demonstrating problems in practical geometry, then drawing of elementary forms and problems as the bases and simple elements of the most elaborate designs. Drawing of machinery is then taken up, leading the student systematically through all the details of his art, from the drawing of a nut-head or a screw to the complete engine with all its appurtenances. Shading, coloring, perspective and free-hand drawing are also elaborated. The first 116 pages of the book are given to a thorough course on all branches while the latter part is occupied by the plates. This new edition of 1881, is to be sold at a reduced price to place it within reach of apprentices and mechanics who could not heretofore afford it.

THE AMERICAN NEWSPAPER ANNUAL published by N. W. Ayer & Son, Philadelphia, is out for 1881. It consists of 736 octavo pages, being larger and more complete than the edition of 1880, which we took occasion to say, was in our opinion "the fullest, most reliable and valuable work of the kind now before the public." It gives, according to the best knowledge the publishers could obtain, the name of every paper published in the United States and Canada, its frequency of issue, politics or other distinctive features, its size, year of establishment, circulation and advertising rate. Populations of States, counties and towns are given according to census of 1880, and a variety of geographical information which makes the work something more than a newspaper directory.

Referring to the last *Annual* we observe that there are 560 more newspapers published this year than there were last year. There are now 11,234 newspapers distributed as follows: New England States 878, New York 1,288, Middle States 1,344, Southern States 1,818, Western States 5,104, Territories 211, Canadian Provinces 591. New York City of course presents the longest list. This list shows by comparison with the old one that over sixty New York newspapers have disappeared within a year. Journalism seems to be a very precarious business, and some curious facts may be gleaned from a perusal of the last two *Annuals*. The publisher of "Apples of Gold" most likely realized from his enterprise nothing more substantial than pictures of silver, and probably has framed his last issue. The old saying, that "kind words can never die" is disproved for "Kind Words" is utterly defunct. The "Voice from the Old Brewery" no longer offers spiritual (or spirituous) consolation, and even the "Echo" has died out. The disappearance of "Land and Home" and "Church and People" may in some degree be compensated for by the advent of "House and Home," "Fireside at Home" and "Our Home." Although the "Milliner" and the "World of Fashion" have come to an end the ladies may be assured that winter bonnets will be as cute and as expensive as ever. Clouds have obscured "The Morning and Day of Reform," the "Magnet" has ceased to attract, the "Postal Card" has been cancelled, "Water, Gas and Steam" has piped out, and "The Present Century" has prematurely expired.

This week we publish the remainder of Prof. Robinson's paper on Counterbalancing of Engines, etc., which was begun last week. We commend the paper to the careful study of every one interested in building or running steam engines.

The next meeting of the American Society of Mechanical Engineers in this city, November 3rd, promises to be a large and interesting one.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(1) J. E. M., Brooklyn, N.Y., asks: Please inform me which is the proper shape for a diamond-point lathe tool? *A.* A regular diamond-point lathe tool is made by drawing down the end of a rectangular bar of steel square, leaving the corners so that a line drawn through two of them will be parallel with the sides of the bar. The cutting edge is formed by cutting off the top or end of the square at an angle so as to leave the point the highest. The tool may have any clearance desirable. The illustration here shown represents a style of tool much easier and cheaper to make than the one described, besides possessing all its advantages. The tool here shown is made by fullering down a bar of steel full width, then trimming the sides and top to give the cutting edge the proper shape. This tool is the stronger one of the two.

(2). J. T., LaCrosse, Wis., asks as to the practicability of gearing up two engines in a side wheel boat in such a way as to make two revolutions of the engine to one of the wheels? The engines are 21" x 84", and make at present 18 to 20 revolutions per minute. *A.* It is possible to do this, but the plan does not meet with favor from those who have tried it. We have seen small boats geared in this way, but the gears are always troublesome and noisy, and with engines of the size you name the difficulties in the way of properly securing the shafts would be greatly increased, and unless the boat was especially constructed to be geared in this way, we think you would always find trouble in the arrangement.

(3) G. L., Hartford, Conn., asks for information, as to the prospects of a machinist finding remunerative employment in Chili or Peru? *A.* From such general knowledge as we have, we are inclined to think the prospects are much better almost anywhere in the United States—in Hartford, for instance.

(4) G. B., Boston, Mass., asks: 1. Is a railroad machine shop a good place for a person to learn the machinists' trade? *A.* Yes. 2. Can you give me the names of a few machine shops in Boston where a person can learn that trade? *A.* Being in Boston yourself, you can inquire more readily than we can.

(5) F. W., St. Louis, Mo., asks how to cut water-line glasses to the right length? *A.* They may be broken by slightly scratching on the inside with the broken end of an old round file, making a mark entirely around at the place where they are to be broken; or by nicking around the outside with a half round file, when by a slight pressure they will break at the place marked.

(6) I. H., Cohoes, N. Y., writes: I have a block of cast iron, 4 feet square and the same in height, that I want to break up for the foundry. Can it be done by drilling a hole in the center, and using dynamite or glycerine? It stands in a lot away from any house. *A.* We hardly think you will succeed in that way, at least, not with one hole in the center. You might possibly make a success of it by four holes towards the corners, but the expense would be considerable. It is usually found that the cost of reducing such pieces to a condition to be fit for an ordinary cupola is about equal to their value. If any of our readers have had experience with such pieces, we shall be glad to hear from them for the benefit of I. H.

(7) C. H. K., Corry, Pa., asks: If I take the exhaust from one engine to another, and so on to the third, can I get the same power from each engine if the steam would last? The three engines have cylinders of the same size, and are situated some distance apart. *A.* As we understand your question, while it might be possible in some way to arrange things so as to get an equal amount of work from each, the matter is not worth considering, since the total useful work from all would be less than from one alone. You will, perhaps, see this by reflecting that, for instance, in your second cylinder the forward pressure on the piston would only equal the back pressure in the first cylinder – in point of fact, it would be less—hence, at the same speed, all the work done in the second cylinder would represent so much less work in the first cylinder, and so along. A condensing engine is sometimes located at some distance from a non-condensing engine, and run by the exhaust steam from the former, or the two cylinders are located together, making a compound engine, in which case the second cylinder is the larger of the two, so that a definite forward pressure per square inch will result in more work in that cylinder than loss in the other.

(8) E. T., Philadelphia, Pa., asks: 1. Please inform me through the AMERICAN MACHINIST of a good rule for ascertaining the diameter of a shaft to transmit a given power; revolutions and length being given. *A.* You need not take the length into consideration. To find the diameter of a wrought-iron shaft capable of transmitting a given horse power: multiply the given horse power by 125 and divide the product by the number of revolutions per minute; the cube root of the quotient will be the diameter in inches. Example: What should be the diameter of a wrought-iron shaft to transmit 100 horse power, the speed of the shaft being 100 revolutions per minute. $100 \times 125 = 12{,}500$, and 12,500 divided by 100 = 125, the cube root of which is 5; hence the shaft should be 5 inches in diameter. 2. What is the best form of tool for finishing a wrought-iron shaft? *A.* Almost any modification of the diamond-pointed tool, if properly ground, will do good work in finishing wrought iron. Nearly every individual machinist has his own peculiar idea in reference to this matter, and modifies his tool with reference to the particular work in hand.

(9) A. G. C., Chicago, Ill., asks: Will you please tell me how to get the diameter of a worm wheel across the largest part, when the diameter in the center and the thickness are known? *A.* Lay it out with a pair of dividers and measure it. The diameters must be such that your worm will fit it; hence you will have no difficulty in measuring the diameter of the worm, setting your dividers to the radius and striking two circles that shall be so situated as to represent the least diameter of the wheel, and by measuring you can find the greatest diameter.

(10) G. G., Brooklyn, N. Y., asks: 1. Is there a mechanical evening school in Brooklyn, near Atlantic Ave. and Smith Streets? *A.* We do not know: you can learn by inquiring in the supposed vicinity of its location. 2. A friend of mine, with the necessary skill, desires a situation as assistant civil engineer. Will you please tell me how he can best get such a situation, and what are the duties of it? *A.* He should make it known by such means as suggest themselves that he is open to an engagement of this kind. We know of no other way. If, as you say, your friend has the skill of an engineer, he must know what the duties are quite as well as we can tell him.

BUSINESS SPECIALS.

50 cts. a line for each insertion under this head.

Good Blowers Cheap. Machine W'ks, Unadilla, N.Y.

Don't fail to see the New Automatic Engine, built by the Lambertville Iron Works, now running at the American Institute, N. Y.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Sent free by the publisher, Jas. F. Hotchkiss, 84 John Street, N. Y.

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"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. Unbound, three dollars. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Useful Information for Steam Users." A 100 page *Illustrated Pamphlet*. Contains interesting data on the care and management of the steam engine and boiler, and rules for engineers and firemen. The engineers of every well regulated establishment should have this work. Sent by mail on receipt of twenty-five cents in postage stamps. The J. N. Mills Publishing Co., 165 Broadway, New York.

"Paragon" Metallic Piston Rod Packing. See AMERICAN MACHINIST, July 16th, 1881. Write for prices. A. Wilkinson, Manayunk, Philadelphia, Pa

A New Treatise on Steam Engineering, Physical Properties of Permanent Gases and of Different Kinds of Vapor. By John W. Nystrom, C. E., 8vo., cloth. Price, $1.50, also A New Treatise on the Elements of Mechanics, Establishing Strict Precision in the Meaning of Dynamical Terms. By John W. Nystrom, C. E., 8vo., cloth, price. $2.00, Mailed by E. & F. N. Spon. 446 Broome St., New York City, on receipt of price.

MANUFACTURES.

The Chicago *Daily Tribune* says the business of Norton Bros., tin can and package manufacturers, 40 to 46 River Street, of that city, fitly illustrates Chicago's industrial progress. It began in a small way ten years ago, in the loft of a building on Canal Street, under the financial charge of O. W. Norton, and the manufacturing and mechanical direction of Edwin Norton. In that short time the business has grown to be the largest establishment of its kind in the United States, giving employment to 250 hands, and distributing in wages over $100,000 annually. Their factory is full of interesting labor-saving machines, most of them the invention of Edwin Norton. Among the recent inventions are machines for soldering fruit cans, one of which will solder perfectly a car load of cans in ten hours.

E. McCabe & Co., Lawrence, Mass., are about to erect a new boiler shop.

The Nashua Lock Co., Nashua, N. H., is erecting an addition 100 × 20 feet.

The new bolt and nut works of Oliver Brothers & Philips, at Pittsburgh, Pa., are in operation.

The Pennsylvania Iron and Steel Company are to build extensive iron works at Canal Dover, Ohio.

The Iron City Tool Works of Pittsburgh, Pa., have recently made considerable shipments of picks and mattocks to Buenos Ayres and Australia.

Twenty-three miles of spiral pipe were recently shipped on one order by the Abendroth & Root Manufacturing Company of New York.

The Union Machine Shops, St. Louis, Mo., are being enlarged by the addition of a two story brick building, in which new tools will be placed.

At the Reading, Pa., shops of the Philadelphia & Reading Railroad Company, they work twenty-four hours' time every day.

The extensive works of the Singer Sewing Machine Company, at Elizabeth, N.J., it is said, are to be sold because of the high rate of taxes.

The Schenectady Locomotive Works, Schenectady, N.Y., are engaged in erecting extensive additions to their shops.

The Southwark Foundry and Machine Company, Philadelphia, Pa., have orders for the Porter-Allen high-speed engine that will keep them busy for some months.

The Coles Machine Tool and Steam Motor Company have fitted up new works on Hamilton St., Philadelphia, and will manufacture the Tyson engine.

The Terre Haute and the Indianapolis Car Works are to consolidate at the latter place, where they propose to establish the largest car works in the world.

A Boston oil cloth manufacturing firm is said to be negotiating for the purchase of the old cotton mill at Steubenville, Ohio, the intention being to establish a Western branch manufactory.

Business is now very brisk around the Cooper's Point and South Camden, N. J., ship yards. It is estimated that the combined capital of those engaged in this industry amounts to $250,000.

The Worcester Wire Co., Worcester, Mass., have just put in a new 500 horse power Green engine (26" × 40"), to which a new Bulkley condenser is to be attached. They have also put in three 80 horse power boilers, and over three hundred feet of new shafting.

The Atlas Engine Works, of Indianapolis, Ind., are building two Corliss engines, of 100 and 150 horse power, for the C., St. P., M. & O. R. R. They are to be placed in their new shops at St Paul, Minn. They have also received another order for an 80 horse power Corliss engine from Gaff, Gent & Thomas, Columbus, Ind.

Hewes & Phillips, Newark, N. J., amongst other orders for their high-speed Allen engine, have one for a 22"x30" to run at 200 revolutions. They are also very busy on machine tools. They have a large number of their new iron planers under way, some of them of great capacity as to length. They are melting ten tons of iron per day.

Newly Incorporated Companies.

ILLINOIS.

The Traver-Nixon Broom Company, Charleston; Jas. A. Connally, Wm. G. Wright and R. A. Traver, corporators; Capital, $15,000 The manufacture and sale of brooms and broom materials.

Belleville Pump and Skein Works, Belleville; Fred. Sattler, Charles Becker and Henry Schmidt, corporators; Capital, $25,000. To manufacture and carry on a general foundry and machine shop.

Saxony Water-Proof Goods Company, Chicago; E. B Collins, W. K. Swallow and C. D. Hooker, corporators; Capital, $100,000. To manufacture and sell cloth and paper of all kinds.

The Eagle Milling Company, Quincy; Henry S. Osborn, Rodney Lambert and Henry Meisser, corporators; Capital, $60,000. To manufacture and sell flour and transact a general milling business.

The Chicago and Western Railroad Company; George Merryweather, Wm. L. Glass, Arthur Ryerson, A. J. Atwater and Robert F. Stevens, corporators; Capital, $200,000. To construct and operate a line of railroad from the city of Chicago, in the County of Cook, in a westerly direction to some point in the westernmost boundary of the County of Cook and the State of Illinois. Principal office, Chicago.

Neoga and Southern Railroad Company, Neoga; Tracy Kingman, S. F. Wilson, W. W. Whitney, W. B. Phillips, D. W. Ragsdale, P. Wilshimer, Cyrus D. Green, M. Vatan, G. W. Albion, H. C. Winshall, F. D. Voris, H. A. Aldrich and W. H. Singer, corporators; Capital, $200,000. To construct and operate a line of railroad from the village of Neoga, in Cumberland County, in a south-easterly direction, through the Counties of Cumberland, Effingham and Jasper, to a point where the said railway shall join or intersect the Springfield, Effingham and Southeastern Railroad, in the said Counties of Effingham or Jasper, all in the State of Illinois.

Northwestern Watch Case Company, Rockford; Levi Rhoades, James S. Ticknor and Hosmer P. Holland, corporators; Capital, $50,000. The manufacture and sale of watch cases and other articles and things connected therewith.

The Smoke Annihilator Company of Illinois, Chicago; Albert Galloway, George Field and M. Van Allen, corporators; Capital, $100,000. To manufacture and apply to furnaces an apparatus designed to consume smoke, and to deal in like articles, steam boilers and steam fitters' supplies.

PENNSYLVANIA.

C. M. Crandall Company, Montrose, Susquehanna County; Chas. M. Crandall, Fred. W. Crandall, B. L. Baldwin and others, corporators; Capital, $100,000. For the purpose of manufacturing toys, etc.

Mittany Valley Railway Company, Bellefonte; Robert Valentine, J. D. Valentine, Adam Hoy and others, corporators; Capital, $25,000. To construct a narrow gauge railroad in Center County, Pa.

Loiseau Fuel Company, Philadelphia; Richard A. Lewis, William B. Smith, Chas. J. Taylor, and others, corporators; Capital, $50,000. To manufacture a patent compressed fuel.

The East Branch Tionesta Railroad Company, Sheffield, Warren County; Walter Horton, Jerry Crary, Chas. Sigel and others, corporators; Capital, $100,000. To construct a railroad with a gauge not exceeding three feet, from a point on the Tionesta Valley Railroad, up Tionesta Creek, a distance of fifteen miles in Warren County.

Hillside Railroad Company, Pittsburgh; Edward House, Thos. H. Phelps, Henry M. Long, and others, corporators; Capital, $50,000. To construct a road from Pittsburgh to Knoxville, a distance of 2½ miles.

MASSACHUSETTS.

John A. Gale Company, Georgetown; Ira O. Sawyer, President; John A. Gale, Treasurer; Capital, $15,000. For the manufacture of boots and shoes.

NEW JERSEY.

Foreign Evaporating and Sugar Manufacturing Company, Jersey City; William F. Browne, Emile A. Legrand and William A. Brown, corporators; Capital, $1,000,000. To sell foreign patents and machinery for the manufacture of sugars and the evaporation of all liquids, etc.

Brown & Legrand High-Pressure Gas Generating and Ore Desulphurizing Company, Jersey City; Capital, $1,000,000. The sale of machinery and apparatus for generating gas or steam under high pressure in the desulphurization of ores, etc., and the sale of patent rights.

Eclipse Improved Wheat Cleaning Machine Company, Camden, N. J., and Philadelphia, Pa.; Wm. L. Peters, Edwin T. Allen and James A. Brown, corporators; Capital, $1,000,000. To manufacture and sell the eclipse improved wheat-cleaning machines.

Browne Ceramic Clay and Lime Burning, Vitrifying and Calcining Company, Jersey City; William Frank Browne, William A. Brown and Emile A. Legrand, corporators; Capital, $1,000,000. The sale of machinery and apparatus for generating gas or steam in the burning of ceramic clay and lime, and for vitrifying and calcining, etc.

Consolidated Underground Cable Company, Jersey City; Andrew J. Baldwin, John H. Miller, M. W. Hayward, and others, corporators; Capital, $1,000,000. To erect and construct public or private works, and the manufacture of materials and machinery relating to electrical matters.

Browne High-Pressure Gas Generating and Marine Motive Power Company, Jersey City; William Frank Browne, William A. Brown and Emile A. Legrand, corporators; Capital, $1,000,000 The sale of machinery and apparatus for generating of steam or gas under high pressure in connection with navigation, etc.

Barnes Iron Mining Company, Annandale; Lewis Barnes, J. Hunter Brown and James A. Brown, corporators; Capital, $200,000. To mine iron ore and other metals, and erect mills for the smelting of the same, in the county of Huntedon.

Cerquis Luminous Paint Company, Camden; John R. Maxwell, Charles Oakford and F. E. Engleman, and others, corporators; Capital, $500,000. To manufacture and sell luminous or other paints, oils, etc.

NEW YORK.

The Pittstown Paper Company, Troy; Charles White, Robert J. Clark and P. Harter, corporators; Capital, $10,000. To manufacture and sell paper.

The Crown Mills Company, Marcellus, Onondaga County; Stephen Barker, A. T. Sullivan and Theo. F. Vail, corporators; Capital, $40,000. To manufacture and sell woolen goods and other textile fabrics.

American Gas Machine Company, New York; Alex. Gilmour, Elliot Williams and Chas. J. Smith, corporators; Capital, $5,000. To manufacture, sell and put up for use, gas machines.

Mayhew Motor Company, Limited, Poughkeepsie; Z. Rudd, John Trowbridge, Chas. P. Luckey and others, corporators; Capital, $30,000. To manufacture and sell the Mayhew motor and its appendages.

The Jeanette Iron Mining Company, Middletown, N. Y.; Vandewater Smith, Rufus W. Leavitt and Phillip F. Kobbe, corporators; Capital, $5,000. To mine and smelt iron.

The De Forrest Company, New York; David W. De Forrest, Ogden P. Pell and Geo. Godfrey, corporators; Capital, $100,000. To manufacture, use, maintain and sell mechanical and chemical appliances for the transmission and reception of messages.

Mutual Electric Light and Supply Company, New York; Abram M. Lonyea, Bernard Laude and Charles E. Long, corporators; Capital, $320,000. To manufacture and sell electric lights, machines, generators and all appliances connected therewith.

American Electric Railway and Power Company, New York; Wm. E. Young, C. Jerome Fiquet and James E. Chandler, corporators; Capital, $10,000,000. To manufacture, own, furnish, let and sell machinery for operating locomotives and other engines and boats by the application of electricity.

Machinists' and Engineers' Supplies.

NEW YORK, Oct 27, 1881.

This week reminds us somewhat of the 1873 panic, for the reason that some of the dealers are doing very little, because of their inability to obtain goods. One dealer tells us that he has been unable to get any screw plates since June 1, 1881, and his prospects for obtaining a supply in the near future do not brighten. Any one who is fortunate enough to secure an assortment readily finds customers. Taps, dies, machine screws and drop forgings, as well as forged steel goods, continue very scarce. No changes in values.

The Ashcroft Manufacturing Co., 111 Liberty Street, New York, are preparing a new catalogue.

H. Prentiss & Co., 42 Dey Street, New York, are the manufacturer's agents for a new steel pipe cutter, and are introducing the same.

Iron and Metal Review.

The Pig Iron market continues active and strong in tone. We quote prices unchanged, as follows:

Foundry No. 1, $25 to $26; Foundry No. 2 X, $23; Gray Forge, $21 to $21.50. The demand for Foreign Iron continues good, with prices as follows: Gartscherrie, $24.75 to $25; Coltness, $26.50; Langloan, $26; Glengarnock, $25; Carnbroe, $24.75; Eglinton, $23.50 to $24.

The demand for Steel and Iron Rails is active with prices unchanged. The market for old rails is fair. We quote old T rails at $28.50 to $29 and Double Heads at $31.50 to $32. The demand for Wrought Iron Scrap is active; No. 1 is quoted at $31 for foreign and $32.50 for prime selected from yard. The demand for manufactured iron continues active, and sales large. Copper is in fair demand at 18c. to 18¼c. for Lake Superior, and 18c. for Baltimore. Straits Tin, 21¾c.; Australian, 21¾c.; and Billiton, 21¼c. Lead, 5c. Spelter, Western, 5¾c.; Silesian, 5⅞c.; Spelter, 13¼c. to 13¾c.

WANTED

Wanted.—Second-hand or New 50 to 75 H. P. Automatic Cut-off, Condensing, Horizontal Engine. Send full details to Box 10, AMERICAN MACHINIST, 96 Fulton Street, New York.

Wanted.—Two or three Machinists, with a small capital, to rent a new machine shop, with foundry and blacksmith shop attached, well stocked with the best new tools; power will be furnished. A good chance will be given to the right parties. Also to rent, with or without power, second flat, size 100x45 feet, well lighted and heated. Address J. B. Howell & Co., corner 6th Street and West Avenue, Long Island City, N. Y.

Wanted.—A Machinist Foreman to handle about sixty hands to best advantage. Applications must give all particulars. Address W. H., 96 Fulton St., New York City, N. Y.

Wanted.—Situation by a practical Machinist and Draughtsman, has had many years experience, as foreman. Address "Machinist," care AMERICAN MACHINIST.

Wanted.—A reliable man to take charge of machinist department in a hardware manufactory. Must be generally competent to manage men, build machinery, make patterns, tools, adjustments, etc. Address, giving experience and place of residence to Foreman, Box 4, AMERICAN MACHINIST, N. Y.

Wanted.—Two Lathe hands, first-class to work on engines and general machine work. Good wages and steady employment. Address, McEwen Brothers, Wellsville, N. Y.

Wanted a situation as foreman in an iron foundry, by a competent and reliable man. A1 references. Address "Foreman," 35 Arctic Street, Bridgeport, Conn.

A thoroughly competent and experienced steam engineer wants a situation of responsibility, with compensation corresponding to the degree of service rendered. Can furnish every required evidence of ability and reliability. Address, "Chief Engineer," office AMERICAN MACHINIST.

A Marine Chief Engineer, of an extensive experience, wishes a situation to run an engine, or take charge of the steam heating apparatus of a building. Is capable of handling all kinds of steam apparatus and do his own repairs. Best of references. Address R. L., Box 12, Office AMERICAN MACHINIST, 96 Fulton Street, New York.

Position as Foreman, by one that has had large experience; is a practical machinist and tool maker. A 1 references. Address S. C. L., 813 Sackett St., Brooklyn, N. Y.

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139, 141, 143 Centre Street, New York.

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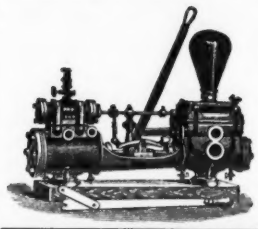

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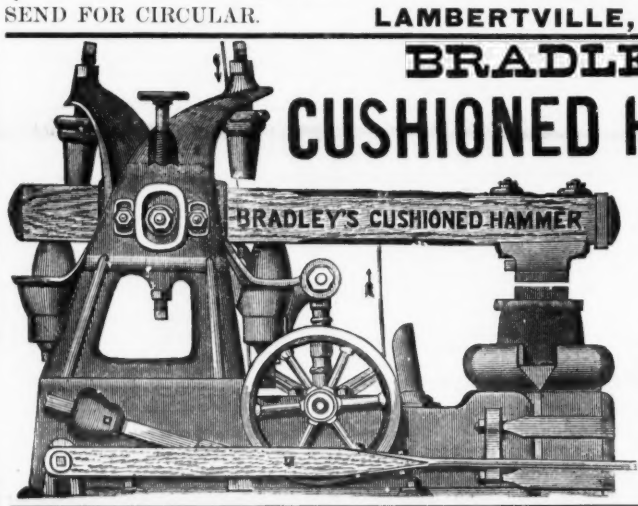

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